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Evaluating the Nutrition and Health Benefits of the Special Supplemental Food Program for Women, Infants, and Children

**Advisory Committee
on Nutrition Evaluation**

FNS-165

**United States Department of Agriculture
Food and Nutrition Service**

U. S. Congress
Washington, D.C.

To the Congress:

Public Law 94-105 revised Section 17 of the Child Nutrition Act of 1966 to extend the Special Supplemental Food Program for Women, Infants and Children (WIC Program) to September 30, 1978. Section 17(f) requires that an Advisory Committee be established for the purpose of determining and recommending in detail how, using accepted scientific methods, the health benefits of the WIC Program may be best assessed and evaluated.

Legislation specifies that the Committee study the methods available to evaluate successfully and economically, in part or in total, the usefulness of the medical data collected and the methodology used by the Department of Agriculture and the Comptroller General of the United States prior to March 30, 1975; and study the applicability to an evaluation of the WIC Program of other Federal and State health, welfare, and nutrition assessment and surveillance projects currently being conducted. The Committee's report of its study is herewith submitted to the Congress. The Department's plans for assessing the nutrition and health benefits of the WIC Program are also presented.

After reviewing previous nutrition surveys and considering the objectives and operation of the WIC Program, the Committee developed four proposed evaluations. The four proposals are interrelated and represent different levels of evaluation which could be performed singly or in combination. Proposal I could be completed prior to September 30, 1978, the termination date of the WIC Program's current legislation; Proposals II, III and IV could not be completed prior to that date.

Proposal I, Nutrition Evaluation Using Existing Data, is to evaluate the nutritional status of WIC Program recipients using existing data which were collected at the time of entrance to the Program and after participation. Proposal II, Nutrition Surveillance, is to provide a system for periodically estimating the nutritional status of WIC Program recipients based on some customarily used

indicators. Proposal III, In-Depth Evaluation of Nutrition and Health Status of WIC Program Recipients, is to evaluate the effect of participation in the WIC Program using a variety of indicators of nutrition and health status of selected recipients. Proposal IV, Nutrition Status Evaluation of Recipients and Non-Recipients, is to determine if the WIC Program is serving those persons at greatest need of Program benefits.

The Committee recommended that Proposal I be implemented as expeditiously as possible and that Proposal II be implemented when it is known whether the WIC Program will be extended beyond September 30, 1978. Precise recommendations regarding the implementation of Proposals III and IV were not made. However, the Committee noted that Proposal III would provide an improved understanding of the nutrition and health benefits being derived by WIC Program recipients and that Proposal IV would provide a more complete understanding of the individuals being served by the Program.

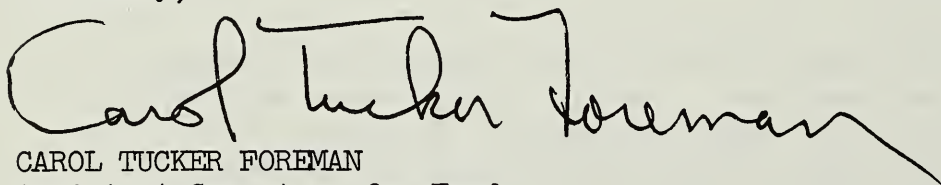
The Department is very appreciative of the contributions provided by the members of the Committee. Careful consideration has been given to all aspects of the Committee report. We believe that it is essential to recognize the current limitations of methodologies to assess nutritional and health status, and consequently to assess the effectiveness of nutrition intervention programs as presented in the report. Furthermore, the Department supports the Committee's position that properly conducted evaluations would improve understanding of the population served by the WIC Program and provide an improved understanding as to the effectiveness of the Program.

The Department has initiated several activities consistent with the recommendations in the Committee's report. We are in the process of preparing a summary of previously conducted evaluations of the health benefits of the WIC Program. Data that will be used for this purpose are available from the Detailed Medical Evaluation, the nutrition surveillance activities being directed by the Center for Disease Control, and various studies that have been conducted by State and/or local agencies participating in the WIC Program. This effort deviates from the recommendations contained in Proposal I. However, it is consistent with the philosophy of that Proposal, and more importantly will be available for use during the 1978 legislative session.

Planning has been initiated with the Department of Health, Education and Welfare to expand the Center for Disease Control Nutrition Surveillance Program to additional health clinics operating the WIC Program and to provide the Department with continuous direct assessments of the impact of the WIC Program. This collaborative effort with the Center for Disease Control will be implemented contingent on renewal of WIC Program legislation. The Department agrees with the Committee that nutrition surveillance, as suggested in Proposal II, would be more beneficial to the WIC Program than any other single evaluation because of the potential for improving WIC Program administration in addition to the evaluative component.

The Department is continuing to study the Committee's other proposals. However, we believe that no decision should be made on Proposals III and IV until the future structure and nature of the WIC Program have been determined.

Sincerely,

A handwritten signature in cursive script, reading "Carol Tucker Foreman". The signature is written in dark ink and is positioned above the typed name.

CAROL TUCKER FOREMAN
Assistant Secretary for Food
and Consumer Services

Honorable Bob Bergland
Secretary of Agriculture
Washington, D.C. 20250

Dear Mr. Secretary:

The Advisory Committee on Nutrition Evaluation is pleased to submit its report to you on evaluating the health benefits of the Special Supplemental Food Program for Women, Infants and Children (WIC Program).

In preparation of the Committee report and our recommendations, we considered nutrition evaluations which were performed in the United States and which have application for future evaluations of the WIC Program.

The four proposed evaluations which the Committee developed differ according to their objectives and complexities. An evaluation of data currently available is the only evaluation that could be performed prior to the termination date of current legislation for the WIC Program. A continuous nutrition surveillance evaluation has the greatest potential for providing a positive impact on the WIC Program. Nutrition surveillance would provide for a continuous assessment of the nutritional and health status of WIC Program recipients and would improve operation of the Program through upgrading and standardizing procedures used by local health agencies. The Committee believes that the two other proposed evaluations would enhance understanding of the nutritional and health status of WIC Program recipients and would provide information on the extent to which the WIC Program is serving individuals at greatest nutritional risk.

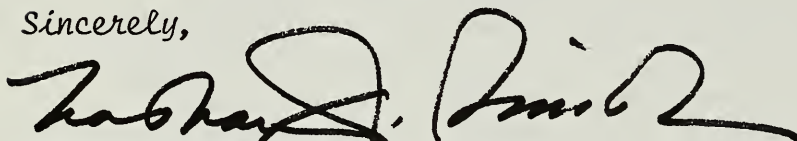
The applications and limitations of each proposed evaluation are presented in our report. Furthermore, the limitations of evaluating nutrition intervention programs such as the WIC Program are reviewed. Some areas requiring further research that would enable more specific evaluations of the impact of nutrition intervention programs are discussed.

The Committee is of the firm opinion that the evaluations, if properly conducted, would provide an improved understanding of the population being served and the effectiveness of the WIC Program. Our recommendations pertaining to the implementation of the proposed evaluations are consistent with the current legislation for this Program. The information derived from each proposed evaluation will differ. The

most comprehensive understanding of the health benefits of the WIC Program would be obtained if all proposed evaluations are performed. A decision to proceed with such a comprehensive evaluation program should be made only after critical consideration of future legislation and Program priorities.

The preparation of this report was possible because of the commitment of members of the Advisory Committee on Nutrition Evaluation. Appreciation is extended to all members for their diligent efforts and contributions. The staff support provided to the Committee was essential to the successful completion of this report, and the U.S. Department of Agriculture personnel who provided these services are to be commended.

Sincerely,

A handwritten signature in black ink, appearing to read "Nathan J. Smith". The signature is fluid and cursive, with a large loop at the end.

NATHAN J. SMITH, M.D., Chairman
Advisory Committee on Nutrition Evaluation

Acknowledgment

The Department of Agriculture would like to express sincere appreciation to the Committee on Nutrition Evaluation.

The professional manner in which the Committee approached and completed its task of recommending how the WIC Program may be best evaluated is appreciated. The expertise, guidance and assistance of each member contributed to the quality of this report. The degree to which the objectives of the Congress and the Department were achieved can be attributed to these individuals and the organizations they represented.

Advisory Committee on Nutrition Evaluation

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An Advisory Committee on Nutrition Evaluation was established pursuant to Public Law 94-105 to determine how best to evaluate the health benefits of the Special Supplemental Food Program for Women, Infants and Children (WIC Program). The Committee consists of 12 members representing various health care professions. In this report, nutrition evaluations performed in the United States, which may have application to future evaluations of the WIC Program, are summarized. Information derived from these previous evaluations was used in the development of the four proposed evaluations of the WIC Program which the Committee presents in this report. Recommendations on how best to evaluate the WIC Program are also made.

Eight nutrition evaluations performed on segments of the U.S. population and considered by the Committee were the Ten-State Nutrition Survey, Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey); Health and Nutrition Examination Survey (HANES); Center for Disease Control (CDC) Nutrition Surveillance; Evaluation of a State WIC Program; General Accounting Office (GAO) Report to the Congress—Observations on the Evaluation of the Special Supplemental Food Program, Food and Nutrition Service (FNS); Evaluation of the WIC Program Delivery System; and a Medical Evaluation of the WIC Program. Summaries of the objectives, duration, design, methodology, sample, major findings and a commentary are presented for each study. Methodologies and results of each study pertaining to women, infants, and children are reviewed with emphasis on the relation of the findings to future evaluations of the WIC Program.

The objective of the Ten-State Nutrition Survey was to determine the magnitude and location of poor nutrition and related health problems in the United States. It was

conducted from 1968-1970 and results were published in 1972. The survey was limited to 10 States and New York City, and the findings are not considered representative of the U.S. population or U.S. poverty population. The types of data collected included general demographic information and information on nutritional status derived from biochemical tests, clinical examinations, dental examinations, anthropometric measurements, and dietary information. The sample included approximately 40,000 individuals. However, there was a relatively small amount of data on pregnant and lactating women, infants and preschool children included in this evaluation.

The Ten-State Nutrition Survey demonstrated that many methods of traditional nutrition surveys are too imprecise to be relevant to the U.S. population. Traditional clinical examinations are of little use for uncovering nutritional problems in the U.S. population. Findings of the Ten-State Nutrition Survey relevant to the WIC population were: 1) poor nutrition increased as income level decreased; 2) growth deficit was a common problem, particularly among the poor; 3) obesity and overweight were widely prevalent; 4) there was a high prevalence of low hemoglobin levels, particularly among the lowest income groups; 5) protein and most water soluble vitamins (B vitamins and vitamin C) were not deficient in the population; 6) mean dietary intakes for infants met the standards for all nutrients except iron; 7) in general, intakes other than iron paralleled overall energy intake.

The Study of Nutritional Status of Preschool Children in the United States provides an overview of descriptive information on nutritional status of preschool children in the United States. Data were collected on a cross-sectional sample of children 1-6 years of age between 1968 and 1970. Measurements used to assess the nutritional status of

the population included dietary intake, clinical examinations, dental examinations, anthropometric determinations, and biochemical evaluations. This is the most comprehensive evaluation of nutritional status of preschool children which has been performed in the United States. However, because of low response rates, the results are not considered representative of U.S. preschool children and national estimates should not be made.

Major findings of the Study of Nutritional Status of Preschool Children in the United States which have application to the WIC Program were: 1) clinical signs of nutritional deficiencies were minimal; 2) evidence of nutritional risk clustered among children of lower socio-economic status; 3) black children were heavier and taller than white children but white children were more fat; 4) among the socio-economically depressed the problem was more one of lack of sufficient quantity of food than of nutritional quality of food; 5) children in the lower socio-economic groups, especially black children, had the highest rate of dental caries.

One objective of the Health and Nutrition Examination Survey (HANES) is to measure nutritional status of the U.S. population and monitor changes over time. Data reported in the Preliminary Findings of the First Health and Nutrition Examination Survey were collected between 1971-1972. In this report preliminary findings are complemented by data collected through 1974. The first HANES used a stratified multistage probability design in the selection of a sample representing the civilian U.S. population 1-74 years old. Through HANES I, 1,489 children were examined. However, no data were collected on infants. Nutritional status was assessed through clinical, anthropometric, biochemical, and dietary data.

Results of HANES which are considered pertinent to an evaluation of the WIC Program were: 1) black children were slightly taller, heavier, and less fat than white children; 2) mean skin-fatfold measurement, mean body weight relative to height, and prevalence of thin children were not related to socio-economic status; 3) dietary energy consumption was lower in children of the poverty group; 4) dietary iron consumption was lower in poor black children than other groups because of consumption of less food, not lower iron content of foods; 5) black children of all income levels had lower hematocrit and hemoglobin values than white children of similar income levels (this difference was believed to be genetic rather than nutritional), prevalence of low hemoglobin and hematocrit values was higher for the poverty group than nonpoverty group; 6) clinical and biochemical evidence of protein deficiency was not observed among the children; 7) women of child bearing age in the poverty group were more obese than those in the nonpoverty group; 8) hematocrit and hemoglobin values and iron consumption differences showed the same ethnic and income gradients in women as were observed in children.

Center for Disease Control (CDC) Nutrition Surveillance Program monitors indicators of nutritional status in the lower socioeconomic population of participating States and identifies particular nutrition problems in target populations. Data collection and analysis began in 1973 and is continuous. Eleven States are currently participating in the surveillance program. CDC's Nutrition Surveillance Program analyzes simple indicators of major childhood nutrition problems including anemia, linear growth retardation, and overweight and underweight. Plans are currently being made to include data on pregnancy and pregnancy outcome in the Nutrition Surveillance Program. Data ob-

tained by local clinics in the normal course of patient care are collected by State Health Departments and analyzed by CDC. Results are reported to local clinics for use in program planning and evaluation. Since data are collected primarily for program purposes, quality control is a major problem. Additionally, results are not representative of the U. S. population because of self-selection of participants and the limited number of States included.

Results of the CDC Nutrition Surveillance Program related to the WIC Program are: 1) approximately twice the expected prevalence of children are found below the fifth percentile of height or length for age (NCHS growth standards¹¹); 2) excess weight for height is more prevalent than low weight for height; 3) anemia rates vary considerably by State, age, and ethnicity.

The Louisiana evaluation of the WIC Program is included as an example of a State evaluation supported in part by CDC's Nutrition Surveillance Program. The objective of the Louisiana surveillance program is to provide information on trends of indicators of nutritional status and nutritional need of lower socioeconomic populations in the State. Results are used for planning and evaluating preventative health-care programs in the State. The nutrition surveillance system is based on data obtained primarily through Early Periodic Screening, Detection, and Treatment Program (EPSDT) and is compared to data on WIC Program recipients from parishes in which the program is available. All children receive comparable health care and education but only those children residing in parishes where the WIC Program is operated receive the supplemental food package. Therefore, comparisons of children receiving the food package and children not receiving the food package can be made. Demographic, anthropometric and hematological data are

obtained for each child. Initial surveillance data analyzed were based on 6,202 infants and children enrolled in EPSDT in 1973. Initial data on WIC Program participants were obtained from 10 parishes during 1975 and included records of 1,465 children.

This evaluation of the WIC Program in Louisiana demonstrates the possibility of identifying a population comparable to the WIC Program population, at least infants and children, to which comparisons can be made. Results relevant to the WIC Program were: 1) approximately 20 percent of the population had low hemoglobin or hematocrit values prior to nutrition intervention—the prevalence rate of anemia was higher in blacks than whites independent of income (however, no allowance was made for ethnic differences in normal hemoglobin and hematocrit levels in this evaluation); 2) approximately 20 percent of children were below the fifth percentile for height and weight; 3) a higher percentage of children not receiving the WIC Program food package persisted with low height for age than was observed for children receiving the WIC Program food package, but the difference was not statistically significant; 4) mean hemoglobin and hematocrit values were higher, and prevalence of anemia lower, among children who had received WIC Program foods for one year; 5) selected indicators of nutritional status were worse for program dropouts than for those who remained in the program.

The objective of GAO's Report to Congress — Observations on Evaluation of the Special Supplemental Food Program, FNS, was to provide Congress with information on the Detailed Medical Evaluation and Delivery Systems Evaluation of the WIC Program. Information was collected beginning in 1973, and the report was submitted to Congress in May 1975. At the time the review was made, the evaluations were in the developmental phase. Information was presented on the

progress of WIC Program implementation, design and implementation of WIC Program evaluations, and problems inherent to human nutrition evaluations. Conclusions of GAO included: 1) evaluations of health benefits of nutritional assistance to humans are limited by lack of health standards, nutrient standards, suitable comparison groups, and applicable indicators of mental development; 2) results of the Medical Evaluation would be difficult to interpret because of the limited time period to conduct the study, insufficient training, and methodologies used.

The WIC Program Delivery Systems Evaluation was performed to evaluate management efficiency, management effectiveness, and operational costs of the food delivery systems used in the WIC Program. Data were collected during 1975 through interviews with program administrators, recipients, nonrecipients and food distributors. The sample consisted of 96 WIC projects but was not representative of the WIC Program since it was selected to include all three food delivery systems used in the WIC Program. Information was collected to evaluate the food delivery systems; retail purchase, direct distribution and home delivery, in terms of administrative efficiency, cost, and satisfaction of and convenience to program recipients. This evaluation identified certain factors which should be considered in future evaluations of the WIC Program including availability and frequency of participation in health care services, degree of recipient satisfaction with the food package, effectiveness of nutrition education, socioeconomic status of participants and sharing of WIC Program foods by household members.

The overall objective of the Medical Evaluation of the WIC Program was to determine the impact of the WIC Program on the nutritional and health status of program participants. A comprehensive evaluation

was performed between 1974 and 1975 in 19 WIC Program projects. Since at the time of this evaluation few projects were available, it was not possible to do a probability sampling. Therefore, the results are not representative of the WIC Program. In this evaluation, 41,330 infants and children were examined; 11,390 were re-examined after 6 months program participation and 6,256 were re-examined after 11 months participation; 9,967 women were examined and 5,417 were re-examined after program participation. Information was collected on demographic characteristics, anthropometric measurements, biochemical measurements, and dietary consumption. The use of multiple indicators in this study was expected to provide a comprehensive evaluation of the changes in nutritional status among program participants.

The major conclusions reported by the principal investigator were: 1) an acceleration in growth of infants and children in weight and height was associated with the WIC Program; 2) a consistent increase in mean hemoglobin levels of infants and children and reduction in the prevalence of anemia was observed after program participation; 3) pregnant women who participated in the WIC Program gained more weight during pregnancy than women in the initial population; 4) an increase in mean weight of babies was associated with the WIC Program; 5) an increase in mean hemoglobin concentration and reduction in anemia rates were observed in women pregnant for more than 28 weeks and postpartum women. The Committee recognized that the investigator performed this medical evaluation of the WIC Program under difficult circumstances and unrealistic time constraints. The Committee is concerned about the appropriateness of some indicators used for assessment of nutritional status, accuracy of some methods used and validity of some conclusions reported. Therefore, the Committee

recommends that conclusions be drawn from the data with caution.

The review of previous nutrition surveys provided an overview of methodologies currently being used to evaluate nutritional status and of the results obtained. The Committee's expertise made it possible to determine aspects of the methodologies that could be applied or adapted for future studies on the nutritional impact of the WIC Program.

In addition to considering the methodologies and results of previous studies, the Committee recognized the difficulties inherent in evaluating the nutrition and health benefits of nutrition intervention programs such as the WIC Program. The most precise method of demonstrating program effectiveness, the use of true control groups deprived of program benefits, is unacceptable ethically and a less precise alternative method must be used. The indicators of nutritional status have inherent limitations; they are influenced by factors other than nutritional status, the techniques for measurement are limited and standards for comparison are not adequate for all indicators. Additionally, any evaluation of the WIC Program must address the integrated program, and therefore it is not possible to determine the relative contributions of the separate components such as the food package and nutrition education.

In consideration of the information provided by the review of previous studies, the recognition of difficulties inherent in conducting such investigations, and an awareness of the objectives and operation of the WIC Program, the Committee determined that a properly conducted evaluation would improve understanding of the population served by the WIC Program and the effectiveness of the program. Also, infor-

mation gained could improve administration of the WIC Program and services provided.

The Committee therefore developed four proposals for evaluating the WIC Program. The proposals are interrelated; they represent different levels of WIC Program evaluation which could be performed singly or in combination. Proposal I could be completed prior to September 30, 1978, the termination date of the current legislation; Proposals II, III, and IV could not be completed prior to this date.

The objective of Proposal I — Nutrition Evaluation Using Existing Data — is to evaluate the nutritional status of WIC Program recipients using data that are currently available. This evaluation would assess nutritional status at the time of entrance to the WIC Program, evaluate possible trends in changes of nutritional status and identify procedures for data collection and methodologies for analysis which would provide the most relevant information in future evaluations.

Proposal I would utilize existing anthropometric and hematological data on WIC Program recipients which were collected at the time of entrance to the program and after participation. The evaluation would be implemented in local clinics in States currently participating in CDC's Nutrition Surveillance Program plus other local agencies with comparable data. Data would be analyzed cross-sectionally and compared to standards and previously reported data on the U.S. poverty and nonpoverty populations.

Through this evaluation utilizing existing data, an indication of the prevalence of inadequate growth and hematological values in the WIC population would be provided. Depending on data available it might also provide a limited indication of any effect of participation in the WIC Program on

hematological and anthropometric measurements. This evaluation would have an impact on future evaluations since it would provide the opportunity to determine the minimal essential nutrition indicators feasible for inclusion in nutrition surveillance. However, conclusions which could be drawn from this evaluation would be limited because data have been collected primarily for program purposes. Additionally, the local agencies participating would not be representative of local agencies operating the WIC Program. Since no data would be available on nonrecipients, it would not be possible to conclude that changes are due to the WIC Program.

This proposed evaluation would take approximately 1 year to complete. It is estimated that the contract for this evaluation could be obtained for approximately \$200,000.

The objective of Proposal II — Nutrition Surveillance — is to provide a system for periodically evaluating nutritional status of WIC Program recipients. This evaluation would assess the nutrition and health status of WIC Program recipients to determine the benefits of the WIC Program. It would also determine if participation in the WIC Program is associated with increased utilization of health services. Effective projects would be identified, and techniques for administration of the program would be investigated.

Data on customarily measured indicators of nutrition and health status — including anthropometric and hematological determinations, immunization records and receipt of prenatal care — would be collected on a continuous basis using a standardized protocol. The evaluation would be initially implemented in the States participating in CDC's Nutrition Surveillance Program with the intent to extend it to all States. Data

would be analyzed centrally, both cross-sectional and longitudinal analyses of the data would be performed.

Nutrition Surveillance would demonstrate certain nutrition-related problems in the WIC Program population, evaluate nutrition and health benefits of the WIC Program, determine if participation in the WIC Program is associated with increased utilization of health services and improve the quality of procedures used in the collection and interpretation of data at local agencies. However, initial results would not be representative of the WIC Program, and it would not be possible to conclude that observed changes are results of the WIC Program alone.

This proposed evaluation would be continuous. The first report would be available 2 years after initiation. It is estimated that the contract for this evaluation could be obtained for approximately \$250,000 the first year and \$200,000 each year thereafter.

The objective of Proposal III — In-depth Evaluation of Nutrition and Health Status of WIC Program Recipients — is to provide an in-depth evaluation of nutrition and health status of selected WIC Program recipients. This evaluation would use a variety of indicators of nutrition and health status to evaluate the effect of participation in the WIC Program. It would enhance understanding of the effect of the WIC Program by using several additional indicators which may not currently be used in the WIC Program. This evaluation would also provide the opportunity to evaluate the feasibility of having local agencies utilize techniques that would provide more precise measures of nutrition and health status.

This evaluation would require the collection of extensive data from a small number of selected local agencies. It would be

performed using the most sensitive techniques of assessment under rigidly controlled and standardized procedures. All data would be analyzed at a central location. Data would primarily be analyzed longitudinally; however, comparisons with standards and previous findings on the U.S. poverty and nonpoverty populations would also be made.

An indepth evaluation of the WIC Program would indicate nutrition and health benefits being derived by WIC Program recipients in selected projects. The use of numerous indicators would provide for more definitive conclusions, identification and assessment of the effect of the WIC Program on nutrition problems other than hematological and anthropometric, and identification of potential health problems in WIC Program recipients. This evaluation would also provide an indication of the impact of the WIC Program on the family unit. In addition, the applicability of additional indicators for use by local agencies would be investigated. The results of this evaluation may not be representative of the WIC Program. However, this evaluation would demonstrate potential benefits and limitations that could be expected from the WIC Program.

This evaluation would take a minimum of 3 years to complete. It is estimated that the contract for this evaluation could be obtained for approximately \$1.75 million.

The objective of Proposal IV — Nutrition Status Evaluation of Recipients and Non-recipients: Reaching Those Most in Need of Program Benefits — is to determine if the WIC Program is serving those persons most in need of program benefits. It would determine if persons at greatest nutritional risk who are eligible for the WIC Program actually participate, and would identify reasons for nonparticipation among eligible persons.

The evaluation would be performed in a small number of selected local agencies. Using nutrition/health indicators of local agencies, it would evaluate the nutritional status of persons who are not WIC Program recipients but are eligible for the WIC Program based on USDA income and residence requirements. To determine if the WIC Program is reaching persons at greatest need, findings would be compared to similar data on WIC Program recipients collected at the time of entrance to the program. Interviews would be performed to determine reasons for nonparticipation.

Through this evaluation it would be possible to determine the extent to which those persons at greatest nutritional risk who are eligible for the WIC Program are receiving WIC Program benefits. Reasons for nonparticipation of eligible persons would be determined. This evaluation would also identify good agencies and successful practices and policies of these agencies. However, it would not evaluate the effect of participation in the WIC Program on nutritional status.

This proposed evaluation would require 3 years to complete. It is estimated that the contract for the evaluation could be obtained for approximately \$750,000.

The Committee is of the opinion that the most comprehensive and beneficial evaluation of the WIC Program would be provided through a combination of the above four proposed evaluations. Nutrition Evaluation Using Existing Data (Proposal I) should be implemented as expeditiously as possible to provide information prior to September 30, 1978, the termination date of the current legislation. Nutrition Surveillance (Proposal II) should be implemented when it is known whether the WIC Program will be extended beyond 1978 since this evaluation has the potential for having the greatest impact on

Summary

the WIC Program of all the proposals. Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients (Proposal III) and Evaluation of Nutritional Status of Recipients and Nonrecipients — Reaching Those Most in Need of Program Benefits (Proposal IV) would contribute to a greater understanding of the WIC Program and a more complete interpretation of Proposals I and II.

The applications and limitations of indicators of nutrition and health status currently available for use in nutrition evaluations and standards available for comparison are discussed in this report. The Committee recommends that additional funds be allocated for research on nutrition and health assessment including biostatistical and epidemiological design, physical fitness, body composition, dietary consumption, food utilization, body content of essential nutrients and neurointegrative function tests. Research and development in these areas are essential to effectively determine nutrition/health status of the U.S. population and the impact of nutrition intervention programs such as the WIC Program.

Introduction

Establishment of an Advisory Committee on Nutrition Evaluation was mandated by Public Law 94-105, enacted October 7, 1975, to determine how best to evaluate the health benefits of the Special Supplemental Food Program for Women, Infants and Children (WIC Program). The legislation states that "this Committee shall study the methods available to evaluate successfully and economically, in part or in total, the health benefits of the Special Supplemental Food Program. The Committee's study shall consider the usefulness of the medical data collected and the methodology used by the Department of Agriculture and the Comptroller General of the United States prior to March 30, 1975. The study shall also include the applicability to an evaluation of the Special Supplemental Food Program of other Federal and State health, welfare, and nutrition assessment and surveillance projects currently being conducted. The purpose of the Advisory Committee shall be to determine and recommend in detail how, using accepted scientific methods, the health benefits of the Special Supplemental Food Program may best be evaluated and assessed." The legislation delineated specific organizations associated with the fields of health and nutrition from which the Secretary of Agriculture was to select the membership of the Committee. The law also permitted the Secretary to select other representatives when deemed appropriate. Consequently, the Committee had the benefit of expertise from diverse health disciplines as is indicated by the organizations which members represented.

In this report the Committee presents summaries of nutrition evaluations performed in the United States which may have applications for future evaluations of the WIC Program. The Committee gave particular consideration to the difficulties in demonstrating unequivocally the health and

nutrition benefits to recipients from programs such as WIC.

In order to promote optimal health, the WIC Program is comprised of several components—supplemental food, health care, and nutrition education. It is not possible to determine the relative contributions of each individual component to overall program effectiveness since all components of the WIC Program are made available to all participants. Furthermore, due to the synergistic effect of all components it is not possible to determine the contribution of any one component relative to another component. Therefore, any evaluation must address the integrated WIC Program and not its separate components.

A major limitation of evaluating nutrition intervention programs such as the WIC Program is that the available methods appropriate for studies involving human subjects are inadequate for the precise determination of cause and effect relationships. An evaluation of the WIC Program must forego the use of a control group, which would be the most precise method of demonstrating the effectiveness of the program. A control group would afford a comparison between two groups exhibiting comparable degrees of nutritional risk, with only one of the groups allowed to receive WIC Program benefits. Since providing food and health services to one group of persons in need while withholding these benefits from another group equally in need is not ethical, the Committee proposes alternative methods for making appropriate comparisons for future evaluations. Although these methods are ethically sound, they are less precise than the use of true control groups.

Another major limitation in the evaluation of the WIC Program is that the indicators used to determine nutritional status have inherent limitations. Assessment of

nutritional status must be performed through measurement of variables such as height, weight, hemoglobin, hematocrit, levels of nutrients in blood, and dietary consumption data which may indicate nutritional risk. Most of these indicators are not specific for nutritional status since they are influenced by a wide range of factors including age, genetics, environment, and health status. The techniques currently available to measure these indicators also have inherent limitations. Also, standards for comparison are not adequate for all indicators, and there is lack of consensus among professionals concerning values which should be used to denote less than desirable or deficient nutritional status. Because of these limitations, some WIC Program recipients may demonstrate indications of nutritional risk for reasons other than poor nutrition. In such cases, improved nutrition will produce no observable improvement in the indicators. As a result, the demonstrable beneficial effects of the WIC Program on the nutritional status of recipients as a whole will be diluted as determined by traditional measures of nutritional status.

These difficulties associated with determining nutritional status have also been addressed in the Forward Plan for Health.^{1/} Descriptions of some indicators used to evaluate nutritional status are presented in this report, as well as information on their current usefulness and limitations in nutrition and health status evaluations.

With ample consideration given to the limitations of evaluating nutrition intervention programs, the Committee remains of the firm opinion that evaluations, when properly conducted, would provide an improved understanding of both the population being served by the WIC Program and the effectiveness of the program. Additionally, information would be provided to improve

administration of the WIC Program and the services being provided program recipients.

The Committee presents in this report various proposals for future evaluations of the WIC Program. Future evaluations of the WIC Program could proceed simultaneously at several levels. The proposed evaluations are of varying complexities and are designed to complement each other. The period of time required to perform each evaluation and the certainty with which conclusions could be made about program benefits also differ. Some evaluations can be done quickly, but their results will be more significant if performed in conjunction with more lengthy and detailed evaluations. Effective quality control procedures must be instituted in all facets of each evaluation to ensure the validity and reliability of data collected.

The Committee recognized the preventive and remedial aspects of the WIC Program when considering future program evaluations. All persons eligible for participation in the program, as determined by local agency certification standards and procedures, would be eligible to participate in any of the proposed evaluations. Most of the indicators of nutritional status that have been specified for the various proposed evaluations can be used to address preventive as well as remedial aspects of the program. If an indicator of nutritional status demonstrates nutritional risk or poor nutritional status for an individual prior to program participation and there is a true improvement in the indicator with participation, this represents a "positive remedial" result. If an individual enters the program with a healthy value for the indicator of nutritional status and there is no deterioration of the same indicator (worsening of the condition) following program participation, this represents a "positive preventive" result.

Finally, some areas have been identified as requiring future research that would allow more specific evaluations of the impact of nutrition-related programs on the health of individuals or groups. The specific areas requiring improved methodologies for quantitative assessment as discussed in this report are: physical fitness, body composition, dietary consumption and food utilization, body content of essential nutrients, and neurointegrative function tests. Improved methodologies in these areas must be complemented by improved statistical and epidemiological methodology to evaluate the WIC Program without using control groups.

The Committee reviewed existing literature on recent nutrition surveys of various segments of the U.S. population. Prior surveys of the WIC Program were also considered to provide a historical perspective from which to consider recommendations for effective future evaluations of the WIC Program.

The Committee critically reviewed the methods used by investigators in carrying out each of these studies. It considered specific aspects of each survey such as the populations included, indicators used to determine nutritional status, the time period during which data were collected and procedures for analyzing the data. The results of each study pertaining to women, infants, and children were reviewed with particular emphasis on the possible applications and limitations of the findings to future evaluations of the WIC Program.

This section of the report includes a summary of each major study that was reviewed by the Committee. The objectives, duration, design, methodology, sample, and results are presented as appropriate for each study. A commentary about the relevance of methods and results to future evaluations of the WIC Program is also presented.

Objective

The objective of this survey was to determine the magnitude and location of poor nutrition and related health problems in the United States. Emphasis was placed on obtaining information from low-income segments of the population since poor nutrition was believed to be most prevalent among these groups. This was the first large-scale nutrition survey conducted in the United States.

Duration of the Survey

In 1967 Congress mandated that information be obtained concerning the problems of serious hunger and undernutrition in the United States. The Ten-State Nutrition Survey was conducted in response to that mandate under the direction of the Nutrition Program of the National Institutes of Health, U.S. Department of Health, Education and Welfare (DHEW). Data were collected from June 1968 to July 1970, and a report of the results of this survey was published in July 1972.

Design

Ten States were selected to provide a population representative of the target groups which were to be studied. These States were assumed to have (1) large numbers of poverty families and (2) a high prevalence of poor nutrition and associated problems.

The survey was limited to ten States and New York City because of constraints on time and funds. Although the primary interest was poor nutrition among low-income populations, the sampling frame of the Ten-State Nutrition Survey did not include all of the lower income groups within a State nor did it include only the poor.

The sampling procedure was designed to select a random sample from geographic locations with average incomes in the lowest quartile of the 1960 census data. Because of low response rates, the investigators had to accept volunteers, and some participants were paid to participate. Therefore, the sample and the survey cannot be considered representative of either the U.S. population in general or the poverty population as a whole.

A uniform survey protocol, including standards and guidelines for evaluation of the biochemical and dietary data, was developed by the Nutrition Program after consultation with various expert committees. In each participating State a coordinating group for the State was identified, and the State health department or a medical school recruited a survey team and conducted the survey. The Nutrition Program provided consultation, technical assistance, monitoring, and analysis of data. The data were evaluated to enable comparisons to be made which might reflect the effects of regional and economic factors on nutritional status. The data were not

analyzed by State because the number of observations was too small for meaningful statistical analysis after the necessary groupings according to age, sex, ethnic group, and income.

Methodology

The types of data collected included general demographic information and nutritional assessment information based on clinical examinations, anthropometric measurements, biochemical tests of blood and urine, dental examinations and dietary data. The methods were similar to those used in nutrition surveys performed under the Interdepartmental Committee on Nutrition for National Defense protocols. Indicators used are discussed more specifically as follows:

Demographic — Demographic data were collected on about 24,000 families. Information on income, household size, age, sex, education, and ethnic group was obtained.

Clinical and Anthropometric — Clinical and anthropometric data were collected from all participants. Clinical observation was made of overt clinical signs of poor nutrition such as abnormalities of hair, eyes, tongue, lips, skin, and thyroid. Dental examinations were performed to detect decayed, missing, and filled teeth and to evaluate gingival status. Wrist X-rays were performed to determine bone age and detect calcification abnormalities. Anthropometric measurements included weight, height, triceps skin-fatfold thickness, head circumference (on infants only), cortical thickness of bone and skeletal maturation.

Biochemical — Biochemical tests to determine hemoglobin and hematocrit values were performed on all individuals who attended the clinics (approximately 40,000). In addition, many individuals had one or more of the following tests: serum albumin, serum protein, serum vitamin A, serum vitamin C, serum folic acid, red blood cell folate, urinary riboflavin, urinary thiamin, and urinary iodine.

Determinations of serum iron and transferrin saturation were made for all pregnant and lactating women, children from birth through 36 months of age, and all subjects with hemoglobin values classified as "low." Complete biochemical tests were carried out on 25 percent of the total number of persons surveyed, and also on several groups of pregnant and/or lactating women, children from birth through 36 months old, adolescents 10 through 16 years old, and half the people 60 years or older.

Dietary — Dietary data included both 24-hour recall information and food frequency data. Twenty-four-hour dietary recall and food frequency data were obtained from half the households while the other half provided only 24-hour dietary recalls.

Sample

The total sample involved approximately 40,000 individuals from 24,000 families. Selected subsamples considered to be at high nutritional risk, including pregnant or lactating women, infants, and young children, received more detailed biochemical and dietary evaluations. Fifty percent of persons examined were children 16 years and under. Thirty percent were persons 17 through 44 years of age, and 17 percent were over 45 years of age. Infants comprised only 2 percent of the sample, and pregnant and lactating women were less than 1 percent. Children 1 through 4 years of age comprised approximately 10 percent. Thus there is a relatively small amount of data available on those particular groups of persons that the WIC Program is intended to serve.

Major Findings Relating to Women, Infants, and Children

1. Clinical examinations failed to reveal any significant number of individuals with overt signs of micronutrient deficiency syndromes.
2. Poor nutrition increased as income level decreased and, largely for this reason, evidence of undernutrition was found most commonly among blacks, less commonly among Spanish-Americans, and least commonly among whites.
3. An excess of undersized children and adolescents was found among all ethnic groups.
4. Obesity and overweight were found to be prevalent, most predominantly among adult women and particularly black women.
5. A high prevalence of low levels of hemoglobin was reported, particularly among the lowest income groups. Low hemoglobin values were believed to be due predominantly to iron deficiency because of the age distribution and low iron consumption indicated by dietary information.
6. Low values for protein, vitamin C, thiamin, riboflavin, and iodine were seldom observed either clinically or on laboratory tests. Although there was a correlation between nutrient intake and income, neither clinical nor laboratory tests revealed abnormalities at any income level.
7. The mean dietary intakes reported for infants were sufficient to meet the standards for all nutrients except iron. However, as expected with this type of data, cumulative percentage distribu-

tions revealed a wide range of intakes with many infants consuming lower amounts of energy, iron, vitamin A, and vitamin C than the standard on any particular day.

Commentary

The Ten-State Nutrition Survey was the first large-scale nutrition survey performed in the United States. This survey demonstrated that many of the methods of traditional dietary surveys are too imprecise and irrelevant to the U.S. population to be useful for domestic studies. The survey raised many questions about the interpretation of biochemical and anthropometric data, and underscored difficulties in standardizing dietary and laboratory techniques. Several observations from this survey would be useful in the planning of a future evaluation of the WIC Program.

Traditional clinical examinations have little utility in uncovering nutrition problems in the U.S. population which are amenable to prevention by the WIC Program because the prevalence of overt clinical malnutrition is low. Although velocity of growth is faster in blacks than in whites, growth deficit is a common—presumably nutrition related—problem among the poor. There is little evidence of either specific protein deficiency or deficiency of most water-soluble vitamins (B group vitamins and vitamin C) in the U.S. population, and in general, the low values observed for nutrients other than iron parallel the overall intake of energy. More direct measures of iron nutriture for application in widespread survey work would be useful. Obesity was observed as being a major problem in children and women. Vitamin A undernutrition, suggested in reports of this survey by dietary and biochemical evidence in certain age and ethnic groups, may not be a major problem in the United States. Subsequent understanding of the physiology of vitamin A transport and utilization, and the inherent difficulties of vitamin A measurement, have cast some doubt on the original interpretation of the vitamin A values obtained in the Ten-State Nutrition Survey. 3/

Objective

The objective of this study was to provide an overview of descriptive data on nutritional status of a cross-sectional sample of preschool children in the United States.

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

Duration of the Survey

The study was carried out on children 1 to 6 years old between 1968 and 1970.

Design

Data were collected on a cross-sectional sample of children to provide a basis for comparisons between subsets of the sample population, between groups of children studied concurrently by different investigators, and to allow comparisons with children studied in the future. A brief summary of sample design is included for this particular study to exemplify one type of procedure that may be used to select the sample in future evaluations of the WIC Program.

The Preschool Nutrition Survey utilized a national probability sample consisting of 74 sample points or Primary Sample Units. The 74 sample points were located in 36 States and the District of Columbia and included 12 major metropolitan areas, 32 other Standard Metropolitan Statistical Areas (SMSA's) and 30 counties or county groups representing the nonmetropolitan or rural portions of the country.

The sample was stratified according to SMSA classification, size of the largest city, rate of population growth, major industry or major type of farming, and in the South, the proportion of population which was black.

Over all regions, SMSA's and counties were assigned to 74 relatively homogeneous groups or strata. Twelve of these strata contained only one primary area each; consequently, those 12 metropolitan areas were included with certainty as sample areas. The remaining 62 strata, averaging around two million in population, contained from 2 to 200 or more primary areas (SMSA's or county groups). From each stratum, one primary area was selected with probability proportionate to population. The sampling process provided approximately equal sample sizes from the 62 primary areas because the

Review of Literature

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

research needs dictated that a self-weighting sample of dwellings be drawn.

As multistage area sampling was continued, the geographical area was divided and subdivided, in two to five stages, into successively smaller sampling units. Cities, towns, and rural areas were the secondary selections within the primary areas. As the stratification continued, 10- to 12-unit dwellings in small towns and villages, and up to 40-unit dwellings in large cities, were included.

To keep sampling and data collection cost at an acceptable level, comparatively large clusters of dwellings were used as sample clusters in which all preschool children (1 to 6 years) were included.

Teams of investigators conducted the study in the following phases: community relations; demographic listing; dietary interviewing; and clinical and laboratory evaluations. The population was subdivided by age and socioeconomic status before analyses were performed. Sex of children was considered only in the analysis of anthropometric data.

The Preschool Nutrition Survey gives an overview of the nutritional status of U.S. preschool children during the years 1968 through 1970, and the data can be used by investigators as a reference with which to compare data from other study populations. The sample drawn from any single Primary Sampling Unit cannot be considered representative of an individual unit. Therefore, it would be inappropriate to extrapolate from one or several Primary Sampling Units to describe the nutritional status of preschool children in a State. However, the numbers of children within major census regions are sufficiently large that interregional comparisons are appropriate.

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

Methodology

Measurements used to assess the nutritional status of the population included dietary intake, clinical examination, anthropometric determinations, and biochemical evaluations. Each of the indicators used in this survey are discussed more specifically as follows:

Dietary—A two-day dietary record was used for the collection of dietary information. The contribution made by vitamin/mineral supplements was included in the data reported. Although data were not included in the published paper, the researchers also investigated differences in dietary consumption and biochemical values between children receiving vitamin/mineral supplements and those not receiving supplements. ⁵/ Percentage distributions of the total daily intakes of protein, fat, carbohydrate, energy, calcium, iron, vitamin A, thiamin, riboflavin, and vitamin C were calculated. Additional dietary information was obtained pertaining to the children's eating practices. Food procurement and preparation practices of the persons caring for the children were also studied.

Clinical—Clinical evaluation of participants included a medical history, physical examination, X-ray examination, and dental examination.

Anthropometric—Anthropometric data collected included height, weight, head circumference, and thoracic fatfold thickness. In the analysis of anthropometric data, children of low birth weight were excluded.

Review of Literature

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

Biochemical—Biochemical indicators studied included hemoglobin, hematocrit, serum iron, percent saturation of transferrin, plasma vitamin A, plasma vitamin C, plasma albumin, plasma urea nitrogen, urinary riboflavin, urinary thiamin and urinary urea nitrogen.

Sample

The sample areas selected included approximately 5,300 children between 1 and 6 years of age eligible for participation in the Preschool Nutrition Survey. These children represented 3,850 families with an average family size of 4.7 persons. The subjects were 52 percent male and 48 percent female. Eighty percent were white, 14 percent were black and 5 percent were Latin American. Eighteen percent of the children were between 12 and 23 months of age; the remainder were equally divided among the four successive 1-year intervals. Of eligible preschool children in the total sample, dietary and demographic information was obtained on 65 percent and complete information (dietary, demographic, clinical and laboratory) was obtained on 40 percent.

Review of Literature

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

A Study of Nutritional Status of Preschool Children in the United States (Preschool Nutrition Survey)

Major Findings

1. Clinical signs of overt nutritional deficiencies were minimal in the population surveyed.
2. Evidence of nutritional risk—lower biochemical indices, particularly iron and hemoglobin, small physical size for age, and low dietary intake—was, for the most part, clustered among preschool children of lower socioeconomic status.
3. Black children were heavier, taller, and less fat than white children for every sex and age group studied (except females 4.50 - 5.49 years). White children were fatter as determined by larger skin-fatfold thickness, for every sex and age group.
4. Nutritional quality of the diet, with the possible exception of ascorbic acid, correlated poorly with socioeconomic status. Among the socioeconomically depressed, the problem was more one of lack of sufficient quantity of food than of nutritional quality.
5. Many preschool children whose diets seemed to be perfectly adequate with regard to vitamins were regularly taking vitamin supplements.
6. Children in the lower socioeconomic groups and particularly black youngsters had the highest rate of dental caries.

Commentary

This study is the most comprehensive evaluation of the nutritional status of preschool children which has been performed to date in the United States. It provides a general overview of the nutritional status of children 1-6 years of age in the United States during 1968-1970. Because a relatively large number of children selected for this study did not participate, the results cannot be considered truly representative of U.S. preschool children. Therefore, no national estimates of nutritional status of preschool children should be made based on these data. However, the data are considered a valid and reliable representation of the nutritional status of the sample studied. Therefore, the data are the best available reference against which the nutritional status of the WIC Program recipients could be compared.

The principal investigator noted difficulties in relating survey findings to functional and health performances of children. This calls attention to the urgent need for development of improved techniques for health and functional assessments of children, such as those presented in the section on "future research needs" of this report.

Objective

An objective of the Health and Nutrition Examination Survey (HANES) is to measure nutritional status of the U.S. population and monitor the changes in this status over time.

Duration of the Survey

HANES includes an ongoing nutritional assessment and monitoring program. Data collection for the first HANE Survey was initiated in April 1971 and ended in June 1974. The first reports of nutritional data were presented in Preliminary Findings of the First Health and Nutrition Examination Survey, 6/7/ published in January 1974 and April 1975. These reports include data collected between April 1971 and October 1972. The preliminary findings are complemented in this summary by further analysis of data collected from April 1971 through June 1974.8/9/10/ (This summary pertains to HANES I only and does not include data from HANES II which are currently being collected.)

Design

The first HANES used a stratified multistage probability design in the selection of a sample representing the continental U.S. civilian population, ages 1 through 74 years. Excluded from the selection process were persons confined to institutions or residing on Indian reservations. Differential sampling was performed to permit more detailed analysis of data for population groups at high risk of malnutrition; the economically poor, preschool children, women of child-bearing age, and the elderly.

Data were collected by mobile teams of investigators which traveled to various locations throughout the country.

The data reported in the preliminary findings were based on a representative subsample of the HANES population. Estimates presented in the reports were weighted, based on the children examined, to reflect the total population. The preliminary reports present the data by age, sex, race, and two income levels with special emphasis on groups considered to be at high nutritional risk.

Methodology

Nutritional status was assessed by recording overt signs and symptoms of malnutrition and measuring selected indicators known to vary with nutritional status. The indicators included dietary intake, clinical, dental, anthropometric, and biochemical measurements. Each of the indicators used in this survey is discussed more specifically as follows:

Dietary—Dietary data were collected by means of a 24-hour recall. The nutrients considered in the preliminary findings and in subsequent reports include energy, protein, calcium, iron, vitamin A, vitamin C, riboflavin, thiamin, and niacin. Nutrients derived from vitamin/mineral supplements were not included in the calculations of nutrient consumption. In the analysis of dietary recall data, mean intakes of the sample population were compared with standards developed with the help of an advisory ad hoc committee which utilized information from the World Health Organization, Interdepartmental Committee on Nutrition and National Defense, Recommended Dietary Allowances as established by the National Academy of Sciences, and the results of the Ten-State Nutrition Survey.

Clinical—Physical examinations were performed to detect clinical signs which may be indicative of nutritional deficiencies.

Dental—Dental examinations were performed to determine the number of decayed, missing, and filled teeth and to evaluate gingival and periodontal status.

Anthropometric—The anthropometric measurements included in this survey to evaluate growth patterns and to detect obesity were height, weight, triceps skin-fatfold thickness, and subscapular skin-

fatfold thickness. The sample sizes of the population subgroups in HANES were large enough to compare the findings between these subgroups directly without relating the data to growth charts for anthropometric indicators. In fact, the sample sizes were large enough to provide a basis for developing revised growth standards for the U.S. population. 11/

Biochemical—Biochemical determinations reported in HANES preliminary findings include hemoglobin, hematocrit, serum iron, percent saturation of transferrin, total serum protein, serum albumin and serum vitamin A. Additional tests performed that will be reported in future reports include serum magnesium, serum cholesterol, urinary creatinine, urinary thiamin, urinary riboflavin, and urinary iodine. For classification and interpretation of biochemical indicators, the data were grouped into classes designated as "low," "acceptable," and "high," in a manner which differs only slightly from the procedures used for the Ten-State Nutrition Survey.

Sample

Household, demographic, and medical history data were collected by interviews on 1734 children and examinations were performed on 1489 children. This represented 99 percent and 85 percent respectively of the preschool children aged 1-5 years selected in accordance with the survey design.

Major Findings Relating to Women, Infants and Children

The following summary statements are drawn from the preliminary reports 6/7/ and subsequent analyses of the full HANES I sample: 8/9/10/

1. Growth data of children substantiated the previously reported observation from the Ten-State Nutrition Survey and Preschool Nutrition Survey that black children are slightly taller, heavier, and less fat than white children. When data were analyzed separately for blacks and whites, the economically poor were observed to be slightly smaller than those from households with incomes above the poverty level.
2. Skin-fatfold measurements which reflect subcutaneous fat, and weight corrected for height among preschool children showed inconsistent differences between the poverty and non-poverty groups and between blacks and whites.
3. No difference was found in mean skin-fatfold measurement or mean body weight relative to height across different socioeconomic groups of children 2-6 years old. No difference was shown across socioeconomic groups in the prevalence of thin children as determined by skin-fatfold measurement or by body weight relative to height.
4. Dietary energy consumption was lower among preschool children in the poverty group than in the nonpoverty group. This difference in caloric intake was proportional to the difference in height observed between these two socioeconomic groups.
5. Dietary consumption data revealed a lower mean iron intake among black preschool children in the poverty group than in other ethnic/income groups. This was due to consumption of a smaller amount of food rather than a lower iron content of foods consumed by the economically poor blacks.
6. Hemoglobin and hematocrit data for preschool children revealed substantially lower values among blacks of all income levels as compared to whites of similar income levels. When analyzed separately for blacks and whites, differences between poverty and nonpoverty groups were observed in the mean values for hemoglobin and hematocrit. The prevalence of low hemoglobin and hematocrit values was generally higher for the poverty group than for the non-poverty group. This finding was, however, more consistent among blacks than among whites.
7. There was no clinical or biochemical evidence of classical protein deficiency among any of the children examined. The mean intake of protein per 1,000 calories showed no consistent relationship with income or differences according to ethnic group.
8. Black preschool children were observed as having lower serum vitamin A levels than white children. The prevalence of low serum vitamin A levels among children was not related to income for either ethnic group. Adult standards of low serum vitamin A levels identify a greater proportion of children below these standards than is found in older age groups. This application of adult standards to children is, however, inappropriate because physiological serum vitamin A levels are lower in

preschool children than in other age groups.

9. Economically poor women of child-bearing age were more obese than women in the nonpoverty group even though the reported caloric intake by the poverty group was lower than that reported by the nonpoverty group. Black women had a higher prevalence of obesity than white women. Over one-third of the economically poor black women were obese by the criteria used.
10. Differences in hematocrit and hemoglobin levels and in levels of iron consumption showed the same ethnic and income gradients for women as were observed for preschool children. Hemoglobin and hematocrit levels were substantially lower among black women of all income levels as compared to white women of similar income levels. When analyzed separately for blacks and whites, differences between poverty and nonpoverty groups were observed in the mean values for hemoglobin and hematocrit. The prevalence of low hemoglobin and hematocrit values was generally higher for the poverty group than for the nonpoverty group. This finding is, however, more consistent among blacks than among whites. Dietary consumption data revealed a lower mean iron intake among black women in the poverty group than in other ethnic/income groups. This was due to consumption of a smaller amount of food rather than a lower iron content of foods consumed by the economically poor blacks.

Commentary

HANES I did not collect data on children less than 12 months of age which is a population of major interest to the WIC Program. Therefore, factors which contribute to differences in nutritional status indicators which are already apparent during the second year of life cannot be evaluated. This is particularly important in judging the smaller size of poor children.

Although energy consumption of preschool children was found to be proportional to body size for all socioeconomic groups, it cannot be determined whether energy consumption determines body size or vice-versa because it is not clear at these mild levels of potential energy inadequacy whether growth is stunted before decreases in fat deposition occur.

HANES data revealed substantially lower hemoglobin and hematocrit levels among black women and preschool children as compared to white women and preschool children. The difference in hemoglobin and hematocrit levels occurred independently of income. It was taken into account when analyses were performed to compare the nutritional status of the poverty and non-poverty groups.

The finding of a negative relationship between obesity and reported caloric intake in women is of interest. The possibility that underreporting of caloric intake by the obese or by the poor might have produced this negative relationship was not substantiated in the following two analyses of the data. The first analysis reveals that the relationship between increasing caloric intake and decreasing skin-fatfold is as true among the nonobese as among the obese. The second analysis shows that the relationship between obesity and decreased caloric intake holds

true among the higher income groups as well as among the poor.

HANES did not identify any children suffering from severe protein malnutrition. Consequently, this survey substantiates the findings of the Ten-State Nutrition Survey and Preschool Nutrition Survey that protein deficiency is very rare among preschool children in the United States. This survey further substantiates the findings of the Ten-State Nutrition Survey in the following observations: vitamin A nutrition among preschool children, as measured by serum vitamin A, is not related to income; the levels of hemoglobin, hematocrit, and dietary iron consumption are positively related to income for preschool children and women; obesity among women is negatively correlated with income.

Objective

The CDC's Nutrition Surveillance Program is intended to monitor certain indicators of nutritional status in the lower socioeconomic population of participating States and to identify the prevalence of particular nutrition problems in the target population to help plan corrective action and evaluate programs. The indicators used are anemia, linear growth retardation, and overweight and underweight as defined by the weight-for-height pattern of the National Center for Health Statistics (NCHS) growth charts.

Nutrition Surveillance Program of the
Center for Disease Control (CDC)

Nutrition Surveillance Program of the
Center for Disease Control (CDC)

Duration of the Survey

The Center for Disease Control, after consultation with five State nutritionists, began to assist State health departments with nutrition surveillance in 1973. Data collection and analysis are continuous. CDC provides information to participating State health departments monthly and performs quarterly formal analyses of data. Additionally, annual data summaries are provided. Initial findings were completed in mid-1973.

Design

State health departments obtain height, weight, hemoglobin, hematocrit, and identifying demographic data on children from medical care facilities and screening programs, including such programs as Head Start; Early Periodic Screening, Diagnosis and Treatment (EPSDT) Programs; Title V Programs; WIC Programs, and other programs which serve potentially high-risk children. The Center for Disease Control analyzes the data and reports the results to the States, which in turn use the data to support and evaluate local program operations. The only data used are those obtained by local clinics in the normal course of patient care. The results and conclusions derived from the data are returned to local clinics to assist them in planning and evaluating their nutrition programs.

Review of Literature

Nutrition Surveillance Program of the
Center for Disease Control (CDC)

Nutrition Surveillance Program of the
Center for Disease Control (CDC)

Methodology

The CDC Nutrition Surveillance Program employs simple indicators which relate to major childhood nutrition problems. These were derived from analyses of the Ten-State Nutrition Survey, the Preschool Nutrition Survey, and HANES. Deficits in linear growth are used to identify retarded growth and development. Weight-for-height relationships are used to identify overweight and underweight. Hemoglobin or hematocrit values are used to estimate the prevalence of nutritional anemia. One State is performing serum cholesterol determinations on high-risk children. Dietary information and biochemical determinations other than hemoglobin and hematocrit are not analyzed at CDC, although many cooperating State programs use such data in their clinics. Plans are currently being made to include data on pregnancy and pregnancy outcome.

Comparisons of the actual data on children are made with reference population norms, such as the NCHS growth charts or "cutoff points" for hemoglobin and hematocrit. These are used to prepare tables which characterize the nutritional status of the target population. The "cutoff points" were derived after consultation with individuals and professional groups, and are based largely on World Health Organization, Ten-State Survey, and NCHS standards.

The nutrition surveillance system has continually found prevalences of anthropometric and hematologic problems similar to those found in the lower socioeconomic groups of the Ten-State Nutrition Survey, the Preschool Nutrition survey and HANES. Quality control of data, both anthropometric and hematologic, has been a major problem in the surveillance system, and a major

benefit of the program has been identification of clinics and individuals doing sub-standard nutritional assessment.

Nutrition Surveillance Program of the Center for Disease Control (CDC)

Nutrition Surveillance Program of the Center for Disease Control (CDC)

Sample

Initially, 5 States participated in CDC's Nutrition Surveillance Program; however, 11 States and two metropolitan areas are currently providing data on a routine basis, not all of which come from the WIC Program.

Results as Reported by the Center for Disease Control

1. Approximately twice the expected prevalence of children are below the fifth percentile of the NCHS growth standards for height or length-for-age. Thus, approximately 10 percent of children are below that cutoff limit. This percentage varies somewhat from State to State, age group to age group, and within ethnic groups.
2. Excess weight-for-height is more prevalent than low weight-for-height, indicating that overweight is a more common problem than underweight in the domestic poverty population.
3. Anemia rates vary considerably among the States, among different age groups, and among the ethnic groups. Anemia rates are generally in the 10 to 15 percent range, based on the following cutoff values:

Age	Hemoglobin	Hematocrit
6-23 mos.	10 gms.	31%
2-5 yrs.	11 gms.	34%
6-14 yrs.	12 gms.	37%
15+ yrs. (female)	12 gms.	37%
15+ yrs. (male)	13 gms.	40%

Commentary

The greatest virtue of the CDC Nutrition Surveillance Program is that it is based on existing data and does not impose a considerable burden of additional work on the cooperating local and State units. The problems being monitored are those considered to be the most prevalent nutritional problems among children in the lower socioeconomic groups. Quality control of data is a major problem because of the large number of clinics participating and the variety of protocols used in the collection of data. Furthermore, personnel obtaining the data have varying degrees of training and motivation. Therefore, erroneous interpretation of data is a potential problem. In addition to meeting its objectives, major accomplishments of the program have been upgraded clinic equipment for weighing, measuring, and doing simple hematologic determinations, and improved motivation of the staff and personnel.

Pregnancy data have not yet been added to the program, in part because of the difficulty of obtaining data on pregnancy outcome for patients from local clinics. In many areas public health departments do routine prenatal care but have no direct access to the outcome data obtained at hospitalization and delivery. Surveillance of the nutritional status of pregnancy should start in pilot areas in mid-1977.

There are philosophic and scientific difficulties with the use of any group of cutoff points for the definition of anemia. The CDC Nutrition Surveillance Program publishes data based on cutoff points. Distributions of the raw data are available for analysis and application of other cutoff points. Hemoglobin and hematocrit values change rapidly with age in the first few years of life. These changes are continuous, and imposition of arbitrary cutoff points on a

smooth curve of decreasing or increasing hemoglobin or hematocrit values imposes arbitrary restrictions. In addition, normal values are influenced by several variables other than nutrition and thus cannot be precisely established. Perhaps hemoglobin and hematocrit data could be treated in a fashion similar to growth data by comparing populations of children to the distribution of values found in well nourished populations or in the general U.S. population.

The anthropometric and hematological results obtained through the program cannot be considered representative of the U.S. population. The States included may not be representative, and participation is voluntary which may impose a "self-selection" bias.

State Nutrition Surveillance Program—An
Evaluation of a State WIC Program 14/15/

State Nutrition Surveillance Program—An
Evaluation of a State WIC Program

Louisiana's evaluation of its WIC Program is presented as an example of a State evaluation. Some of the data used in this evaluation were collected through a nutrition surveillance program.

Objective

The objective of the Louisiana surveillance program is to provide information on trends of certain indicators of nutritional status and nutritional need among lower socioeconomic populations in the State. The results are used to plan nutrition intervention and to evaluate preventive health-care programs in Louisiana.

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

Duration of the Survey

Early in 1972, the Nutrition Program of the Center for Disease Control and Louisiana State nutrition authorities cooperated in developing a statewide surveillance system to collect simple anthropometric and hematologic information on infants and children being screened in public health clinics. The techniques of this system and the management of the data were refined with data collection on infants and children attending EPSDT clinics being initiated in January 1973. The WIC Program was initiated in Louisiana in January 1974, at which time data collection on WIC participants began. While the nutrition surveillance system is based only on initial screening information of EPSDT patients, State personnel obtained followup information from the records of WIC recipients, which was analyzed by the Louisiana Division of Health. Data collection is continuous, with analysis performed at 6-month intervals.

Design

The nutrition surveillance system is based predominantly on data obtained through the EPSDT Program with the WIC Program offering the major intervention techniques in those parishes in which the WIC Program is available. EPSDT is oriented toward low socioeconomic groups and is available in every parish in the State. Consequently, children are screened in each health unit which permits a statewide profile to be obtained. The centralized State Health Department administration enabled similar criteria for program participation to be applied to all children. Furthermore, comparable education and counseling is offered to all children and families with nutritional disorders. The WIC food package is available to eligible children residing in some parishes, but not to children in other parishes since the WIC Program is not available statewide. Therefore, direct comparison groups of children receiving the food package and those not receiving the food package are available.

The data analyses included:

1. The number of WIC Program dropouts and the reasons for discontinuing the program.
2. Comparing selected indicators of nutritional status for WIC participants with those for dropouts.
3. Charting the trends of selected indicators of nutritional status at 3-month intervals for a period of 1 year.
4. Comparing selected indicators of nutritional status for children participating in WIC with children participating in the EPSDT Program in parishes where the WIC Program was not available.

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

Methodology

Demographic data, program administrative information, height or length, weight, and hemoglobin or hematocrit values were obtained for each child. Initial screening data were obtained in the EPSDT Program, while followup data for participants and non-participants in the WIC Program were obtained at 3-month intervals through normal followup procedures by local parish health units. The definitions of "low" hemoglobin and hematocrit values were those used in the Ten-State Nutrition Survey. Height and weight data were classified according to the Stuart-Meredith growth curves.

Sample

The initial surveillance data analyzed were based on 6,202 infants and children enrolled in the EPSDT Program in 62 of the 64 parishes in the State. These data were obtained during the first 6 months of 1973. The initial data on WIC participants were obtained from 10 parishes during 1974 and the first 6 months of 1975. These data were collected during screening in the EPSDT Program when infants and children were being admitted to the WIC Program. Children screened in the EPSDT Program in parishes which did not offer the WIC Program served as a comparison group. A one-third sample of records was taken by the nutrition staff of the Louisiana Division of Health, giving a total of 1,465 records included in the evaluation. Followup information was obtained by parish staffs.

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

Results as Reported by the State Health Department

The evaluation data showed that approximately 20 percent of the population served by the Health Department through the EPSDT Program had low hemoglobin or hematocrit values prior to nutrition intervention. The prevalence rate of anemia was about 22 percent among the black population, as compared with only 10 percent among the white population. The socioeconomic status of all individuals was similar, since all were eligible for the EPSDT Program.

Approximately 20 percent of the children were below the fifth percentile of height and weight standards, with slightly better growth and development patterns observed among blacks than among whites.

After a period of 1 year with all participants getting the same services except for the WIC food package, which was only available in parishes participating in the WIC Program, results indicated the following:

1. There was a higher percentage of children who persisted with low height-for-age in clinics not participating in the WIC Program than in participating clinics. While this indicates continued nutritional "stunting" among children not participating in the WIC Program, differences in growth were not statistically significant.
2. The mean hemoglobin and hematocrit values for children were significantly higher and the percentage of "anemic" children (Ten-State Nutrition Survey standards) was significantly lower among children receiving WIC food packages for 1 year than among those children getting similar health services but not receiving supplemental foods.

3. Most dropouts from the WIC Program were "lost to followup," and dropouts apparently lost benefits from all public health services. Initial measures of the selected indicators of nutritional status were worse for the dropouts than for those children continuing in the WIC Program.

Review of Literature

State Nutrition Surveillance Program—An Evaluation of a State WIC Program

General Accounting Office (GAO)
Report to the Congress—Observations on Evaluation of the Special Supplemental Food Program, Food and Nutrition Service^{16/}

Commentary

This evaluation of the WIC Program in Louisiana demonstrates the possibility of identifying a population comparable to the WIC population, at least infants and children, to which comparisons can be made. In addition, performing this evaluation revealed that to obtain reliable data, necessary equipment must be available and training provided to the staffs of participating clinics.

Surveillance data revealed that, prior to nutrition intervention, the prevalence rate of anemia was higher in the black population than in the white population independent of income. However, the hemoglobin and hematocrit levels used as standards were the same irrespective of ethnic group. The use of these levels does not recognize current research that indicates differences in "normal" hemoglobin and hematocrit levels between blacks and whites.

A number of States are currently involved in similar types of evaluations; Louisiana's study is included in this report as an example. A combination of States that are collecting and compiling such data could be used as a nucleus for a future nutrition evaluation of the WIC Program.

Objective

The objective of this report was to provide Congress with information on the Medical Evaluation and Delivery Systems Evaluation of the WIC Program as mandated by the legislation.

Review of Literature

General Accounting Office (GAO)
Report to the Congress—Observations on
Evaluation of the Special Supplemental
Food Program, Food and Nutrition
Service

Duration

GAO initiated a review of the evaluations of the WIC Program in December 1973. The final report was submitted to Congress in May 1975.

General Accounting Office (GAO)
Report to the Congress—Observations on
Evaluation of the Special Supplemental
Food Program, Food and Nutrition
Service

Design

This GAO Report to the Congress is a consolidation of observations on the Medical Evaluation of the WIC Program and the WIC Program Delivery Systems Evaluation. At the time this review was performed, the contractors were in the formative stages of the evaluations. The Medical Evaluation was under contract with the University of North Carolina at Chapel Hill. The Delivery Systems Evaluation was under contract with the National Bureau of Standards, Department of Commerce and completed by the Urban Institute. GAO was assisted by four consultants with expertise in biostatistics, nutrition, obstetrics and gynecology, and pediatrics in the preparation of this report. Information on the Medical Evaluation was obtained from interim reviews made at the U.S. Department of Agriculture, meetings with the evaluation staff of the University of North Carolina, and with staffs of selected projects which participated in the medical evaluation of the WIC Program.

Review of Literature

General Accounting Office (GAO)

Report to the Congress—Observations on Evaluation of the Special Supplemental Food Program, Food and Nutrition Service

Results as Reported by the GAO Investigator

Information was presented on the progress of WIC Program implementation, the design and implementation of the WIC Program evaluations and problems inherent in human nutrition evaluations.

GAO and their consultants concluded that attempts to determine and evaluate the medical benefits of nutritional assistance to humans are necessarily limited by certain inherent problems in health standards and nutrient standards, and lack of suitable comparison groups and applicable indicators of mental development. In addition to these problems in human nutrition evaluations, it was concluded that the results of the Medical Evaluation would be difficult to interpret because of the limited period during which the study was to be conducted, the insufficient training that was being provided, and the methodologies that were being used.

General Accounting Office (GAO)

Report to the Congress—Observations on Evaluation of the Special Supplemental Food Program, Food and Nutrition Service

Commentary

Certain inherent problems in standards and methodology will preclude the possibility of obtaining definitive answers concerning the health benefits of a nutrition assistance program in the immediate future. However, in future evaluations of programs such as the WIC Program, sufficient safeguards must be instituted to ensure adequate control of the services being provided and the study being conducted. Additionally, the time frame should be sufficient to allow proper training of personnel and validation of methodologies.

Review of Literature

An Evaluation of the WIC Program Delivery Systems 17

An Evaluation of the WIC Program Delivery Systems

Objective

The objective of the WIC Program Delivery Systems Evaluation was to evaluate the management efficiency, management effectiveness and operational costs of the various State and local food delivery systems being used to serve the target population.

Duration of the Survey

The U.S. Department of Agriculture entered into an agreement with the Technical Analysis Division of the National Bureau of Standards (NBS), U.S. Department of Commerce, in November 1974, to develop the survey design and instruments, and to perform this survey. The collection of data was accomplished during April and May 1975 by Associate Control Research and Analysis, Inc. The Urban Institute served as a consultant to these organizations and, as a result of the abolishment of the Technical Analysis Division of NBS, assumed responsibility for analyzing the survey data and preparing the final report for this study. This report was submitted to the Department of Agriculture in September 1976.

An Evaluation of the WIC Program Delivery Systems

An Evaluation of the WIC Program Delivery Systems

Design

This study was designed to provide an operational evaluation of the food delivery systems being used in the WIC Program. Furthermore, the study was designed to provide a profile of health clinics participating in the WIC Program (WIC projects), a profile of persons participating in the program, and a profile of eligible nonparticipants from the selected projects.

This study was based on a sample of WIC projects stratified according to the type of food delivery system being used. The sampling procedure was to randomly select an equal number of WIC projects according to size (authorized caseload) and geographical location (United States according to five regions) for each distribution system. The three food distribution systems were direct distribution, retail purchase, and home delivery. All available local WIC programs utilizing direct distribution or home delivery systems were represented in this evaluation because of the small number of programs with these systems. WIC projects participating in the Medical Evaluation of the WIC Program, those with small caseloads, and those which had been in existence for less than 1 year were not included in the evaluation. Therefore, the sample selected, while being widely representative of WIC projects, could not be considered a probability sample representative of the WIC Program.

Methodology

Data were collected to evaluate the three types of food delivery systems in terms of compatibility with WIC Program objectives, administrative efficiency, cost, and satisfaction and convenience to the program recipients. All data were obtained through interviews. Structured interviews were obtained from State, area, and local WIC project administrators; program participants and eligible nonparticipants; and food distributors associated with this program.

State and area administrative personnel were interviewed to determine the services provided in support of the WIC Program, the costs of providing such services, and their assessment of the program and recommendations for improvement.

Interviews of WIC project personnel were designed to identify general characteristics of health facilities, including the types of health services provided and estimates of the costs for providing the various types of services. Particular emphasis was given to determining the availability of services considered minimal for providing good health care, nutrition education activities, and procedures for outreach. Special attention was also given to determining whether foods or other nutrition supplements (in addition to the WIC food packages) were available for distribution. A very detailed description was obtained of the food delivery systems being used. Other specific types of data that were obtained pertaining to the operation of the WIC Program included procedures for certification and recertification, procedures for authorizing foods, and the expenses associated with operating the program according to food costs, labor costs, overhead costs, and others.

Review of Literature

An Evaluation of the WIC Program Delivery Systems

Approximately 40 participants were surveyed for each of the participating WIC projects. Data were obtained pertaining to general characteristics of participant households, including socioeconomic status and extent of participation in other food assistance programs. Specific types of data were obtained pertaining to the WIC Program such as satisfaction with the foods being received, satisfaction with the food delivery system and the program in general, participation in nutrition education activities, costs and difficulties associated with participating in the program, and medical care utilization in conjunction with the WIC Program.

Interviews were conducted with persons potentially eligible for the WIC Program but who were not participating. Data pertaining to socioeconomic status and reasons for not participating were obtained.

Food distributors that were providing foods to program participants were interviewed to determine the procedures used and any problems encountered. Recommendations for improving the food delivery systems were also obtained.

The analysis of data concentrated primarily on the effectiveness and efficiency of the various delivery systems evaluated. Some general characteristics of the program and participants being served were also presented.

An Evaluation of the WIC Program Delivery Systems

Sample

Interviews were conducted in 96 projects, 60 program areas, and 30 State agencies. Approximately 3600 WIC participants and 141 volunteer nonparticipants were included in this evaluation. Forty-one food distribution representatives were interviewed.

Review of Literature

An Evaluation of the WIC Program Delivery Systems.

An Evaluation of the WIC Program Delivery Systems

Results as Reported by Principal Investigator

1. Approximately 95 percent of the recipients of each food delivery system evaluated were satisfied with their system.
2. Direct distribution advantages were low costs, good control of the food package against unauthorized substitutions, and the physical presence of participants at the clinics to receive nutrition education and to utilize other health services. Its main disadvantages were the comparatively high costs and inconvenience imposed on participants (such as traveling to the clinic and transporting large quantities of foods), minor problems of food stockouts, and inability of some projects to provide perishable foods.
3. Home delivery tended to be more expensive than direct distribution in terms of administrative costs (although, since competitive bidding was feasible, perhaps not in food costs). It was more convenient for participants because fewer visits to the clinic were required and groceries were delivered to homes. However, clinic visits would be necessary if medical services and nutrition education were to be provided. The range of foods handled was complete and stockouts did not usually occur. Control of unauthorized food substitutions was identified as a potential problem.
4. The retail purchase system was midway between the other two systems. Its administrative costs were intermediate and food costs were at retail prices. This system imposed an intermediate level of burden on participants, handled

the full range of foods, had occasional stockouts, and exhibited more frequent unauthorized food substitutions than the other systems. If required to visit the clinic to obtain vouchers, participants could be encouraged to use medical services and receive nutrition education.

5. The average monthly food cost to the program per participant was about \$20. The average monthly administrative costs, per participant, were: all delivery systems, \$4.92; direct distribution, \$4.04; retail purchase, \$4.87; and home delivery, \$5.04.
6. Administrative responsibility for operating the program was shared with the State Health Department and area offices in 72 percent of the clinics studied. In 8 percent of the clinics, the State agency operated the WIC Program directly; in 20 percent of the clinics, the program area office had virtually all responsibility for administration of the program.
7. Sixty-five percent of the WIC projects considered household income when determining eligibility for the program. Anthropometric measurements and laboratory tests to determine nutritional risk were routinely performed in 74 percent of the projects when determining eligibility.
8. Ninety-six percent of program participants were satisfied with the food packages. There were no significant ethnic differences in the desirability of available foods. An increased variety of cereals was desired. Seventy-six percent of the WIC projects always authorized the maximum quantities of foods while the remaining projects

Review of Literature

An Evaluation of the WIC Program Delivery Systems

usually did. Eighty-one percent of households stated that they used the WIC foods to feed the entire family.

9. Although nutrition education was not funded through the WIC Program at the time of the study, the program was associated with an increase in the amount of nutrition education being provided in 63 percent of the sample projects. However, only 12 percent of WIC participants reported that they had learned from the nutrition education activities being provided.
10. WIC participants reportedly increased their utilization of health care services offered by the host clinics. Additionally, administrators estimated that WIC participants kept a greater proportion of health clinic appointments than the same patients would without WIC.
11. The average size of households of WIC Program participants was 4.6 persons. The median income per household was \$4,388. Sixty-five percent of the households were below the poverty level (had incomes less than \$5,038 for a household of four). Nine percent of the households had incomes of \$10,000 or more. Comparatively high-income recipients tended to be found at projects which either lacked specific income criteria for free or reduced-price health care or at projects which had an explicit criterion with a cutoff at a high income level. Food stamps were received by 49 percent of households. Thirty-eight percent of households had children receiving school lunches, and 3 percent of households had children receiving school breakfasts.

An Evaluation of the WIC Program Delivery Systems

Commentary

This study addressed the efficiency and effectiveness of the three major types of food delivery systems utilized in the WIC Program. Information was provided on administrative procedures, cost of delivery systems, and recipient participation and satisfaction with the program. A comprehensive determination of efficiency and effectiveness of the WIC Program would have necessitated an evaluation of changes in nutritional and health status of the participants resultant from program participation, which was not a component of this study.

This evaluation identified certain factors pertinent to a future evaluation of the WIC Program. Some of the factors that should be considered include availability and frequency of participation in health care services, degree of satisfaction with food packages, effectiveness of nutrition education methods, socioeconomic status of participants, and sharing of WIC foods among household members. Consideration of these factors in future evaluations in conjunction with health data obtained from the same projects would provide a better understanding of the benefits being derived by program participants. Additionally, an evaluation similar to the WIC Program Delivery Systems Evaluation, if performed in conjunction with determination of the extent to which persons eligible for the WIC Program participate, would be useful for identifying administrative characteristics of the program which encourage or discourage participation among eligible individuals.

Although the delivery systems were found to be similar in some characteristics, they also had some differences as reported in the results. These differences may

Review of Literature

An Evaluation of the WIC Program Delivery Systems

A Medical Evaluation of the WIC Program^{18/}

influence the effectiveness of the WIC Program by affecting the self-selection of participants and dropouts. Furthermore, these differences may affect the services provided through the program. Therefore, in a future evaluation to determine the nutritional and health benefits of the WIC Program, the types of delivery systems should be differentiated to allow for separate analysis. The nutrition and health status of WIC recipients participating in the different delivery systems could then be compared to determine if the type of delivery system has an impact on the effectiveness of the program.

Objective

The overall objective of the Medical Evaluation was to determine the impact of the WIC Program on the nutrition and health status of program participants.

Review of Literature

A Medical Evaluation of the WIC Program

A Medical Evaluation of the WIC Program

Duration of the Survey

The U.S. Department of Agriculture contracted with the University of North Carolina at Chapel Hill on November 28, 1973, to perform a medical evaluation of the WIC Program. This evaluation was originally intended to be accomplished within a 13-month period. This time limitation was imposed because of a desire to provide a report to the Congress in March 1975 for consideration in conjunction with future WIC Program legislation. Consequently, the contractor for this study was confronted with attempting to design, implement, and perform a comprehensive evaluation in an unrealistically short period of time.

Collection of data began on February 1, 1974, and was completed on May 29, 1975. The final report of the results of this evaluation was submitted to the Congress on July 15, 1976.

Design

This study was designed to evaluate the impact of the WIC Program, using selected indicators of nutrition and health status. The indicators selected included numerous nutrition-related variables which should reflect the changes in nutritional status when performed in accordance with a uniform protocol. Changes in the indicators measured in groups before and after program participation were expected to provide an estimate of the nutritional impact of the program.

The WIC projects which participated in this study were selected by FNS from some of the initial applications for participation in the WIC Program. The criteria for selecting projects included:

- Absence of a similar type of supplemental food program for the same target group. Areas which were operating or had recently terminated other feeding programs were excluded to permit an unbiased evaluation of the benefits from the WIC Program alone.

- Adequacy of medical facilities, equipment, and staff necessary to conduct the evaluation.

- The severity of the nutritional risk in the population areas served by the project. Nutritional risk factors which were considered included the prevalence of pregnancy; rates of prematurity; miscarriage and low birth weight rates; rates of infant mortality and morbidity; and the known incidence of additional health problems among women, infants, and children.

The percentage of residents in the project area with low incomes and other factors which could affect their ability to secure adequate nutrition.

The number of expected participants in each category of eligible persons, and any demographic characteristics which might affect the medical evaluation of the WIC Program.

The projects selected gave urban and rural representation, ethnic variation, and broad geographic distribution. The projects selected were not a probability sample representative of the WIC Program, because of the limited number of applications available when the projects were selected.

All women, infants, and children who received supplemental foods from the selected projects were accepted for inclusion in this medical evaluation. The objective of the design was to compare data obtained on program recipients prior to receiving food supplementation, with data obtained on recipients after receiving food supplementation for predetermined periods of time. Consequently, "baseline data" were obtained at time of admittance to the WIC Program. Women were re-examined at subsequent predetermined periods during pregnancy, at delivery, and after delivery. Infants and children were re-examined after 6 and 11 months of program participation.

Most indicators used in nutrition evaluation are affected by many nonnutritional factors such as changes in physiological status and age. Consequently, interpreting the effect of food supplementation is more difficult in studies where the food supplement is being received by all persons being examined. A study consisting of two distinct groups of persons of comparable

nutritional risk, with only one group receiving food supplementation, would enable direct comparisons between groups and thereby provide the best opportunity to demonstrate any differences resulting from the food supplementation. This type of controlled study is ethically and socially unacceptable because it would require withholding benefits from one of two groups of persons in comparable need, while providing benefits only to the other group. A group of persons not receiving food supplements was not studied in this medical evaluation. Consequently, data collected after participation in the WIC Program could not be compared to analogous data from persons who were not in the program.

An attempt to "control" for normal physiologic changes which otherwise would confound any interpretation about the impact of the WIC Program was made by comparing different groups in the evaluation at each stage of pregnancy or of growth and development with baseline data from analogous groups. Any changes that were observed must be regarded as resulting from the total WIC Program including the supplemental food, medical care, education, or other services received. The various components of the program, such as dietary supplement and health care, cannot be evaluated separately since all components of the program were being administered simultaneously during the time this evaluation was being performed.

Methodology

The types of data collected included general demographic information, nutritional assessment information, and information about certain other variables. The evaluation of nutritional status involved anthropometric determinations, dietary intakes, and biochemical measurements. Anthropometric determinations were used to evaluate physical growth. Twenty-four-hour dietary recalls were used to determine daily intakes of nutrients, and a modified dietary history was used to obtain information on food use and usual daily nutrient intakes. Biochemical measurements were used to evaluate selected blood components as concomitants of nutritional status. Other biochemical and clinical data were obtained for women in order to provide a more comprehensive understanding of program participants and a thorough analysis of data. Although each of the indicators used to assess nutritional status may be influenced by factors other than nutrition, the use of multiple indicators in this study was expected to provide a comprehensive evaluation of the changes in nutritional status among program participants.

The indicators used to evaluate infants and children were as follows:

Anthropometric—Anthropometric indicators measured were weight, height, and head circumference.

Dietary—Dietary data were obtained on 25 percent of the infants and children, utilizing a 24-hour recall and a modified dietary history.

Biochemical—The specific biochemical indicators included hemoglobin, hematocrit, mean corpuscular hemoglobin concentration (MCHC), total plasma iron, plasma transferrin, percent saturation of transferrin (PSAT), plasma albumin, total plasma protein, plasma cholesterol, and plasma folacin. The investigators also performed laboratory tests related to plasma complement levels and plasma immunoglobulins.

The indicators used to evaluate pregnant and lactating women were as follows:

Biostatistics—Biostatistical data included fetal and infant deaths, duration of pregnancy and gestational age.

Medical Complications of Pregnancy—Complications included were edema, proteinuria, hypertension and convulsions.

Anthropometric—Anthropometric measures obtained were weight gain during pregnancy including total weight gain and the pattern of weight gain. Birth weight of the baby was also obtained.

Dietary—Dietary data were obtained on 50 percent of the participants, utilizing a 24-hour recall and a modified dietary history.

Biochemical—The specific indicators included hemoglobin, hematocrit, mean corpuscular hemoglobin concentration (MCHC), total plasma iron, plasma transferrin, percent saturation of transferrin (PSAT), plasma albumin, total plasma protein, plasma cholesterol, plasma vitamin

A, plasma carotene, plasma vitamin C, and plasma folacin. The investigators also performed laboratory tests related to plasma complement levels and plasma immunoglobulins.

Lack of linkage between laboratory, dietary, anthropometric, and medical data precluded comparisons of multiple indicators of nutritional status for the same individual.

Sample

The medical evaluation of the WIC Program encompassed 19 WIC projects located in 14 States. Data were collected from participants representing 35,089 households. A total of 41,330 infants and children were evaluated; 11,390 of these participants were re-examined after 6 months on the WIC Program and 6,256 were re-examined after 11 months of program participation. This gives dropout rates of 72 percent at 6 months and 84 percent at 11 months. A total of 9,867 women were evaluated, with 5,417 returning for re-examination, giving a dropout rate of 45 percent.

The participants lived primarily in urban locations (91.6 percent). They generally represented a low-income population, with two-thirds of the households having incomes below the Office of Economic Opportunity income poverty guidelines, and 84 percent eligible for food stamps. The average household size was 4.6 persons.

Results as Reported by Principal Investigator

The major conclusions reported for infants and children are as follows:

1. An acceleration of growth in weight and height was associated with the WIC Program. An increase in head circumference occurred in infants enrolled within 1 month of birth.
2. A consistent increase in the mean blood hemoglobin concentration of participants in the program and a reduction in prevalence of anemia was observed. The main effect occurred during the first 6 months of participation.

The major conclusions reported for women are as follows:

1. Pregnant women who participated in the WIC Program gained more weight during pregnancy than women in the initial population. The maximum difference of about 2 kg. (4 lbs. 6 oz.) occurred in women who were pregnant for 24-31 weeks.
2. An increase in the mean weight of babies was associated with the WIC Program. The impact of the program was greater on black and Spanish-American babies than on white babies.
3. An increase in mean hemoglobin concentration and a reduction in the anemia rate in women who were pregnant for more than 28 weeks and in postpartum women was shown.

A number of other conclusions were made in the body of the report but were not emphasized in the summary by the investigator.

Commentary

The Committee recognizes that the investigator performed this medical evaluation of the WIC Program under difficult circumstances and unrealistic time constraints. There was insufficient time to implement adequate quality control measures, including standardization and training. The Committee is concerned about the appropriateness of some indicators used for assessment of nutritional status, the precision of some methods used, and the validity of some conclusions as reported by the investigator. The lack of a true control group, the comparison strategy necessary, the lack of linkage between initial and followup visit data, the large dropout rate, the absence of information on reasons for inclusion in the WIC Program, and certain of the laboratory procedures suggest that conclusions be drawn from the data with utmost caution.

Training sessions were conducted with persons from each WIC project participating in this study for the purpose of enhancing the accuracy of data collection. The followup review of the projects and the quality control procedures that were used were less than optimal. The variables used to assess nutritional status are subject to observer variation and measurement error, which means that strict protocols should be enforced for the attainment of accurate data.

The number of children re-examined after participation in the program for either 6 or 11 months was small. The improvements reported were calculated by comparing children who remained on the WIC Program and in the medical evaluation for 6 or 11 months, with program entrance data of children at an analogous age. Therefore,

the comparability of this relatively small "self-selected" population to the entire baseline population is questionable. Complex regression models were utilized to evaluate the differences between these two groups. The validity of such models was not fully documented. Comparisons of measurements of individuals before and after participation in the program were not made.

The nutritional risk condition for which each person was admitted to the program was not identified. The data in the report cannot be used to evaluate the appropriateness or "specificity" of the various nutritional risk criteria used in the WIC Program. Therefore, during the analysis of data, the phenomenon of regression toward the mean was not considered. Some of those persons admitted to the program because their value for an indicator fell below the specified level (the criterion for admission to the WIC Program) will, upon remeasurement, be found to be above this level (and therefore normal) even though they have had no real improvement in nutritional status. Consequently, the extent to which the changes reported in this evaluation for those particular indicators can be attributed to the WIC Program cannot be ascertained, especially as methodological and short-term variations were not documented.

While a considerable amount of data relevant to anemia and iron deficiency was gathered, the data and their analyses have not clarified the issue of iron deficiency in the WIC Program participants. Such studies indicate a relatively high prevalence of iron deficiency in populations similar to those eligible for WIC. The conclusions regarding iron deficiency in this medical evaluation are controversial and may be partly the result of inappropriate interpretation of laboratory data. The mean corpuscular hemoglobin concentration (MCHC) was used

as a main indicator for evaluating iron status. The University of North Carolina investigators concluded that improvement in MCHC was the best measure of improvement in iron nutriture. MCHC values improved more than did other indices of anemia. However, MCHC is not generally recognized as a sensitive or specific method of evaluating iron deficiency, or improvement in iron nutriture. The University of North Carolina investigators estimated the percent saturation of transferrin with a new and unstandardized micromethod. Consequently, values reported from this study cannot be compared with results from other studies that utilize conventional laboratory methods. The interpretation of the data on percent saturation of transferrin as reported for this study is not physiologically sound. The saturation of transferrin is affected early in the development of iron deficiency, before anemia is recognized, and may not return to normal values until late during iron supplementation, after hemoglobin concentration has returned to normal. Therefore, persistence of abnormal values of transferrin saturation after hemoglobin concentration has returned to normal range indicates continuing iron deficiency rather than an inconsistent trend as was suggested by the investigator.

Nutrients were calculated from 24-hour recalls. Using these data, the investigator found that many women had low energy intakes during their pregnancy. Participation in the WIC Program did not increase the energy intake although an increase in weight gain during pregnancy was reported. While the investigator found cause to question energy utilization in these women, the Committee would pose either inadequate dietary histories, inappropriate standards, or poor data analysis as alternative explanations.

After considering the accomplishments and limitations of previous nutrition surveys performed in the United States, the Committee developed four proposed evaluations for assessing the nutrition and health benefits of the WIC Program. The Committee's comprehensive review and indepth analysis of previous surveys is only summarized in the preceding section; the contributions of previous surveys is not limited to the brief summaries presented. Since it is intended that any evaluation of the WIC Program be performed within the health care setting, it was also necessary for the Committee to consider the objectives and operation of the WIC Program when developing the proposed evaluations.

The WIC Program provides supplemental foods to pregnant and lactating women, infants and children at nutritional risk as an adjunct to good health care. To be eligible to receive supplemental foods under the WIC Program, infants, children, and pregnant or lactating women must be residents of defined geographical areas, be eligible for free or reduced price health services, and be certified by a competent professional authority to be at nutritional risk. There is a large degree of flexibility provided the State and/or local agencies in making the determination of nutritional risk consistent with the guidelines specified in program regulations. Determination of nutritional risk can be based on one or more of the following: a medical examination, dietary evaluation, anthropometric data, hemoglobin values, hematocrit values, or other indicators of nutritional status.

In this section, the Committee presents four proposals to evaluate the WIC Program. The proposals delineate methodologies utilizing data on customarily measured indicators of nutrition and health

status collected in the past and to be collected in the future, data on indicators of nutrition and health status that are not routinely collected, and data on the extent to which individuals at greatest nutritional risk who are eligible for the WIC Program actually are WIC Program recipients.

For each of the proposed evaluations, information is provided on objectives, scope, methodology, applications and limitations, equipment and expertise required, time required, and estimated cost. The costs presented for each evaluation are estimates. The actual costs could be determined only after detailed protocol for the proposed evaluations have been established. The estimates provided are believed to be minimal amounts consistent with the stated objectives and proposed sample sizes.

The four proposals presented are inter-related and represent different levels of WIC Program evaluations. The proposals may be performed singly. However, the most comprehensive and effective evaluation of the WIC Program would be provided through combinations of the various proposals.

Proposals

Proposal I Nutrition Evaluation Using Existing Data

Proposal I Nutrition Evaluation Using Existing Data

Introduction

This proposed evaluation would provide for an estimation of the nutritional status of WIC Program recipients at the time of entrance to the program. Furthermore, it may be possible to identify trends in changes of nutritional status among WIC Program recipients. This evaluation would also provide information that could be used to enhance evaluation of program benefits in the future.

The WIC Program regulations specify that local agencies participating in the WIC Program determine, as one of the criteria for eligibility, that each person served by this program is at nutritional risk. There are no requirements for the collection of uniform data pertaining to nutritional risk by local agencies. Documentation is required of only the nutritional risk conditions exhibited by recipients upon entrance to the program. Depending on the practice of the local health facility, specific anthropometric, hematological and biochemical tests may or may not have been performed at entrance. Therefore, only anthropometric and hematological data on WIC Program recipients which are available from local agencies participating in the WIC Program could be analyzed.

Through the utilization of previously collected data it would be possible to complete this type of evaluation prior to September 30, 1978, the expiration date of the current legislation. The existing data would not be representative of the entire WIC population and would lack uniform reliability because standard procedures would not have been used during the collection of data. However, some generalizations might be made that would be beneficial to the understanding and future development of this program.

Objective

The overall objective of this proposed evaluation is to evaluate the nutritional status* of WIC Program recipients using existing data. The specific objectives are to:

1. Evaluate nutritional status of WIC Program recipients at the time of entrance to the program.
2. Identify possible trends in changes of nutritional status among WIC Program recipients in selected local agencies.
3. Identify procedures for collection of data and methodologies for data analysis that would provide the most relevant information in future surveillance activities.

* Nutritional status as determined by selected indicators presented under "Scope" for this evaluation.

Proposal I Nutrition Evaluation Using Existing Data

Scope

This evaluation would utilize data which have previously been obtained by local agencies participating in the WIC Program. The primary source of data pertaining to children would be the States participating in the Nutrition Surveillance Program coordinated by the Center for Disease Control. These data are the most readily available and have been collected by some of the participating local agencies continuously for the past 3 years. Local agencies participating in health programs collecting comparable data—such as EPSDT, Maternal and Infant Care (MIC), Children and Youth (C&Y)—would also be included in this evaluation if data are available. Existing data on pregnant women would be obtained from the same States but may be less uniform than the children's data provided through the Nutrition Surveillance Program.

The scope of this evaluation is delineated according to variables that would be considered for each objective as follows:

1. To estimate the nutritional status of WIC Program recipients, an analysis would be performed of data obtained upon entrance to the program. The indicators to be considered include measures of height, weight, hemoglobin or hematocrit for children to 3 years of age. The data available on women in some States is expected to include the amount of weight gained during pregnancy, hemoglobin or hematocrit values, and a determination of the outcome of pregnancy as provided through an assessment of infant birth weight and neonatal mortality data.
2. To identify possible trends in changes of nutritional status, an analysis would be made of data obtained for individuals after program participation for varying

Proposal I Nutrition Evaluation Using Existing Data

periods of time. The indicators to be considered are the same as specified for the first objective of this evaluation.

3. A refinement of the nutrition surveillance activities would be made through (a) an evaluation of the data currently available, and (b) an improved understanding of the capabilities of local agencies participating in the WIC Program to determine and report data essential to an evaluation of the nutrition and health status of individuals being served.

Proposals

Proposal I Nutrition Evaluation Using Existing Data

Proposal I Nutrition Evaluation Using Existing Data

Methodology

Local agencies participating in the WIC Program that have collected the types of data to be utilized in this evaluation would be identified. However, only those State or local agencies that have followed routine procedures during the collection of data would be included in this evaluation.

Prior to analysis, the data would be grouped by sex, age, ethnicity and duration of pregnancy in order to minimize physiological differences. The data would also be stratified according to data collected at entrance to the program and data collected after program participation for varying periods of time to identify trends within the sample population. Each of the indicators, as appropriate, would be compared in a cross-sectional analysis to existing standards and previous findings on the nutrition/health status of the U.S. poverty and nonpoverty populations.

Applications and Limitations

Through this evaluation an indication of the nutritional status of WIC Program recipients would be provided. The prevalence of underweight, overweight, stunting, and low hemoglobin concentrations or hematocrit values among WIC Program recipients would be indicated. This evaluation could also provide an estimate of the adequacy of weight gained during pregnancy. Additionally, on a limited basis, it could provide an indication of the effect of participation in the WIC Program on these indicators.

In addition to providing an indication of the nutritional status of the sample population, a major benefit of this evaluation would be the impact it would have on future evaluations of the WIC Program. Any type of evaluation requires development and implementation of methodologies for performing accurate measurements, designing forms for collection of data and developing data analysis procedures. This evaluation would provide the opportunity to determine the minimal essential indicators of nutritional status that could feasibly be included in a future nutrition surveillance of the WIC Program. Information obtained could be used to refine methodologies and forms used for the collection of data in the future. Furthermore, through this evaluation a data base would be made available for the development and testing of data analysis procedures.

Although an evaluation of the WIC Program using existing data is considered valuable and necessary, conclusions which could be drawn based on these data are limited because of the limitations in the quality of the data. The data that are currently available were obtained for program purposes. The primary reason local agencies

Proposal I Nutrition Evaluation Using Existing Data

participating in the WIC Program have been collecting data in support of the health services being provided. Some methodologies that have been used successfully for screening purposes lack the precision normally required for evaluations. Consequently, a large degree of variability may exist between the local agencies as well as within the same local agency which would restrict interpretation of the data.

Collection of the type of data required for this evaluation has been voluntary on the part of local agencies participating in the WIC Program. The local agencies that currently have data available are not representative of the WIC Program. Consequently, the results of this evaluation would not accurately represent the WIC population. Additionally, since an evaluation would not be performed on nonrecipients, it could not be concluded through this evaluation that the observed changes are results of the WIC Program alone.

The indicators to be considered for the purpose of estimating nutritional status are the same indicators that may have been used as a basis for admittance to the program. Since individuals were admitted to this program because they were judged to be at nutritional risk, individuals erroneously measured too low were included while individuals erroneously measured too high were not included. Therefore, the results of this evaluation would suggest that the sample population is of poorer nutritional status (as determined from data when entering the program) than actually may be the case, and may suggest a higher degree of benefit than has actually accrued because of the tendency of such measurement to regress towards the mean on subsequent measurements.

Proposal I Nutrition Evaluation Using Existing Data

Equipment and Expertise Required

There would be no additional equipment required to implement this proposed evaluation. However, the capacity and expertise to collect and analyze data, including access to computer facilities, would be necessary.

Duration of the Study

This proposed evaluation would be completed in 1 year.

Cost

Depending on the number of WIC projects selected for inclusion in this proposed evaluation, it is estimated that a contract for obtaining and analyzing the data through this evaluation could be obtained for approximately \$200,000.

Proposals

Proposal II Nutrition Surveillance

Proposal II Nutrition Surveillance

Introduction

This proposed evaluation would provide for a system of continuous data collection for estimating the nutritional status of WIC Program recipients as determined by some customary indicators that should be measured in the provision of routine adequate health care. The nutritional status of WIC Program recipients would be determined upon entrance to the program and after participation for varying time intervals to assess the impact of the program. Through this evaluation there would be an upgrading and standardization of procedures for the collection and interpretation of anthropometric and hemotological data by local agencies participating in the WIC Program. This evaluation would initially include those States currently participating in the CDC Nutrition Surveillance Program and subsequently be expanded to additional States. In this way, results could be provided in the most expeditious manner.

The scope of this evaluation would be expanded in relation to current nutrition surveillance activities. Immunization data for infants and children, and prenatal care data for pregnant women would be obtained as indicators of current health status of the recipients. Additional information such as the specific nutritional risk conditions exhibited at the time of entrance to the program would be collected since it is essential for data analysis and an understanding of program benefits. The data to be collected are considered to be the minimum data necessary for providing good health care. Recognizing that this proposed evaluation would take time and effort to implement, it would not be completed by September 30, 1978, the termination date of the current legislation.

Objective

The overall objective of this proposed evaluation is to provide a system for periodically evaluating the nutritional status* of WIC Program recipients. The specific objectives are to:

1. Periodically evaluate the nutrition and health status of one-year-old infants who are WIC Program recipients to determine the effect of receipt of WIC Program benefits on nutrition and health status.
2. Periodically evaluate the nutrition and health status of children 1-5 years old who are WIC Program recipients to determine the effect of receipt of WIC Program benefits on nutrition and health status.
3. Periodically evaluate nutrition and health status of pregnant women who are WIC Program recipients to determine the effect of receipt of program benefits on nutritional status, and determine the incidence of low-birth-weight infants born to WIC mothers, as a function of how early the mothers were placed on the WIC Program.
4. Determine if participation in the WIC Program is associated with increased utilization of health services.

* Nutritional status as determined by selected indicators presented under "Scope" for this evaluation.

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5. Determine effective programs and investigate techniques used by local agencies participating in the WIC Program for administering the nutrition/health components of this program.

Scope

A large number of local agencies participating in the WIC Program would be included in this evaluation. Initially, most of the 11 States currently participating in the Nutrition Surveillance Program coordinated by the Center for Disease Control would be included. However, this evaluation is intended to be extended to all States and local agencies consistent with resources and interest of local agency officials.

Data would be obtained on a continuous basis from WIC Program recipients at intervals consistent with the medical practices of the health facility or the certification and recertification schedule for WIC recipients, whichever is most frequent.

The scope of this evaluation is delineated according to the selected indicators that would be considered for each objective as follows:

1. To evaluate nutrition and health status of infants, measurement of weight, height, hemoglobin and/or hematocrit would be performed and immunization records would be assessed.
2. To evaluate the nutrition and health status of children, measurement of weight, height, hemoglobin and/or hematocrit would be performed and immunization records would be assessed.
3. To evaluate nutrition and health status of pregnant women, measurements of height, pre-pregnant weight (if available), total weight gain and pattern of weight gain during pregnancy, and hemoglobin and/or hematocrit would be used. To evaluate outcome of preg-

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Proposal II Nutrition Surveillance

Proposal II Nutrition Surveillance

nancy, infant birth weight, and, if available, duration of pregnancy and mortality data would be used.

4. To determine if participation in the WIC Program is associated with increased utilization of health services, immunization records of infants and children would be assessed. For pregnant women, data pertaining to the initial visit to the clinic for prenatal care and adherence to the schedule for subsequent prenatal visits would be obtained.
5. To determine effective techniques for administering the nutrition/health component, the more successful local agencies would be identified based on (1) the quality of anthropometric and hematological data submitted, (2) adherence to immunization and prenatal care schedules, and (3) utilization of health services.

Methodology

The data required for this evaluation represent only certain basic indicators that are considered essential for providing adequate health care. This evaluation would be performed using data on indicators which should normally be measured by participating local agencies. Consequently, a large proportion of local agencies participating in the WIC Program should be capable of providing required data, with the possible exception of immunization records. It is recognized that increased resources may be required for the recording and reporting of data, thus possibly adding some administrative and cost obligations to the local agencies.

All indicators to be considered would be determined in accordance with a standardized protocol including training and other quality control procedures to improve reliability and validity of the data. The local agencies participating in the WIC Program would forward the data on a standardized form to a central location for data analysis. The form to be used would be a multipart form which would permit recording all data from followup visits for each individual pertaining to nutrition and health status.

To evaluate nutritional status, the schedule would provide for the collection of data prior to receipt of food supplements and after participation in the program for varying periods of time. The availability of these data would enable cross-sectional and longitudinal types of data analysis. The cross-sectional analysis would provide for comparison of the indicators, as appropriate, to accepted standards and previous findings on the nutrition/health status of the U.S. poverty and nonpoverty populations. The longitudinal analysis would

Proposal II Nutrition Surveillance

provide for identification of changes that may be observed for groups of individuals by comparing observations on the same groups at different points in time. Through analyzing data cross-sectionally and longitudinally, different types of interpretations could be considered, while the confidence pertaining to some interpretations may be improved.

In order to determine if the WIC Program is associated with improved utilization of health services, immunization records and data pertaining to adherence to prenatal care schedules would be evaluated in terms of the standards established by the American Academy of Pediatrics^{19/} and the American College of Obstetrics and Gynecology,^{20/} respectively.

To identify effective techniques for administering the nutrition/health component of the WIC Program, selected variables which may reflect effectiveness such as data quality, adherence to schedules, and utilization of health services would be compared among local agencies to determine the more successful programs. Methods and techniques used in the delivery of services within the successful local agencies would then be identified. It is recognized that the observed variability could reflect local health program practices and/or motivation of participants. However, it is believed that this procedure would be a satisfactory means of identifying effective local agencies participating in the WIC Program. Once effective local agencies have been identified, successful procedures would be reported to other local agencies participating in the WIC Program to be considered for implementation.

Proposal II Nutrition Surveillance

Applications and Limitations

This evaluation would provide an assessment of key indicators of the nutritional status of WIC recipients entering the program. Nutrition-related problems for children would be demonstrated through the prevalence of underweight, obesity, stunting, and anemia. The observations that would be made to characterize the nutritional status of pregnant women include height, pre-pregnant weight, if available, weight gained during pregnancy, duration of pregnancy, acceptability of the pattern of weight gain, and infant birth weight.

The nutrition and health status of WIC Program recipients would be continuously monitored. This would provide a means for observing the nutrition and health status of WIC Program recipients who routinely participate and of those who intermittently participate. Furthermore, it would be possible to observe changes in characteristics of the population entering the program since the nutritional status of WIC Program recipients would be evaluated prior to participation in the program. The nutrition and health benefits of the WIC Program would be evaluated through changes observed in the indicators previously mentioned following program participation. Information on the extent to which participation in the WIC Program is associated with utilization of health care services and its effect on health status of WIC Program recipients would also be assessed.

This evaluation would provide an opportunity for improving procedures for the collection and interpretation of anthropometric and hematological data used by local agencies participating in the WIC Program. Through the utilization of a

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Proposal II Nutritional Surveillance

standardized protocol, it is believed that the procedures used by some local agencies would be improved. The data analysis and reports fed back to the local agencies would lead to an improved understanding of the local WIC recipients and program results. It is envisioned that the "good practices," as identified in the most effective local agencies participating in the WIC Program, would be useful for improving the services being provided by other local agencies participating in the WIC Program.

Since no evaluation would be performed on nonrecipients it could not be concluded through this evaluation that the observed changes are solely a result of the WIC Program. However, it might be possible for some State and/or local agencies to evaluate more precisely the impact of the WIC Program through comparisons of groups who are recipients of EPSDT only with groups who are recipients of both EPSDT and the WIC Program. For such comparisons to be valid it would be necessary for these groups to have similar characteristics.

Initial results of this evaluation would not be representative of the WIC population since the source of data would be limited to local agencies currently participating in nutrition surveillance activities. Results would become more representative of the WIC population as additional local agencies are included in the evaluation. Additionally, while the indicators included in this evaluation are those which are practicable, a more comprehensive evaluation including a larger number of indicators would be essential for more conclusive results.

Proposal II Nutritional Surveillance

Equipment and Expertise Required

Minimum equipment required would include measuring devices for determining length of infants and height of children and pregnant women, beam balance scales for weight measurement, spectrophotometer for hemoglobin determinations or microhematocrit centrifuge and reader for determination of hematocrit. Since this equipment is essential for administering good health care, provisions should be made for obtaining it through funds from HEW, USDA, or other sources if it is not available in clinics.

Duration of the Study

This proposed evaluation would be continuous. The first report would be forthcoming within 2 years after initiation of data collection.

Cost

It is estimated that a contract for compiling and analyzing the data through this evaluation could be obtained for approximately \$250,000 the first year, and \$200,000 each year thereafter. This estimate does not include the cost of personnel that may be required for the collection and recording of data at local agencies or any additional equipment that may be required.

Proposals

Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Introduction

This proposed evaluation would provide for an indepth study of the nutrition and health status of selected WIC Program recipients and an assessment of the impact of this program. It would be designed to examine the indicators of nutritional status customarily used for the purpose of evaluating growth achievement, prevalence of anemia, and outcome of pregnancy. This evaluation would also include other indicators of nutritional status such as body composition and additional blood components as well as indicators of health status. Steps would be taken to ensure data quality and reliability. An extended period of time would be allowed in order to provide optimum conditions for determining the effectiveness of the WIC Program.

In addition to providing an assessment of the health benefits of the WIC Program, this evaluation would provide for the possible identification of certain nutrition-related health hazards among the program recipients such as obesity and hyperlipidemia. Furthermore, data would be obtained to further refine and improve the WIC Program. Since the minimum period of time necessary for completion of this proposed evaluation is 3 years, this study presupposes the WIC Program will be extended beyond September 30, 1978.

Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Objective

The overall objective of this evaluation is to provide an indepth evaluation of nutrition and health status* of selected WIC Program recipients. The specific objectives are to:

1. Evaluate the effects of the WIC Program on the nutrition and health status of recipients, utilizing certain customarily measured indicators of nutrition and health status.
2. Enhance understanding of the nutrition and health status of recipients, utilizing indicators which may not currently be utilized in the WIC Program.
3. Evaluate techniques that would provide more precise measures of nutrition and health status for use by local agencies.

* Nutritional status as determined by selected indicators presented under "Scope" for this evaluation.

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Proposal III

Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Proposal III

Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Scope

This proposed evaluation of the WIC Program would be performed with the most sensitive techniques of assessment available using rigidly controlled and standardized procedures in a selected sample of local agencies participating in the WIC Program. It would necessitate the collection of extensive data from a small number of local agencies selected to be representative of the WIC population. The local agencies selected would be those, in high-risk population areas, serving WIC recipients with documented demographic characteristics. These agencies must also have demonstrated competencies in measuring customary indicators of nutrition/health status.

Data to be collected would include all indicators customarily measured in nutrition surveillance studies. Furthermore, the study would investigate additional anthropometric and biochemical indicators. Dietary intake, mental development, health benefits to recipients and their families, and socioeconomic status would also be investigated.

The scope of this evaluation is delineated according to the selected indicators that would be considered for each objective as follows:

1. The customarily measured indicators used to evaluate nutrition and health status of infants and children would be used including: height, weight, hemoglobin and/or hematocrit, and immunization records. For pregnant women the indicators measured would include weight gain during pregnancy, hemoglobin and/or hematocrit, outcome of pregnancy as determined by infant birth weight, gestational age, and neonatal

mortality, date prenatal care was initiated, missed appointments, and receipt of health services.

2. A number of indicators for determining the same nutrition and/or health condition would be assessed in order to substantiate the effect of participation in the WIC Program on the nutrition and health status of infants, children and pregnant and lactating women. Anthropometric measurements such as skin-fatfold thickness and arm circumference, and dietary consumption data would be evaluated in addition to customary measures of growth in order to provide a more comprehensive understanding of body composition. Indicators of iron nutriture such as plasma ferritin, percent saturation of transferrin, erythrocyte protoporphyrin, and dietary consumption data would be evaluated to augment the interpretation of hemoglobin and/or hematocrit data.

Additional indicators which may be influenced by participation in the WIC Program would also be assessed. Indicators of nutritional status including biochemical measurements of certain vitamins and minerals such as zinc would be evaluated. Additionally, the prevalence of elevated cholesterol and triglyceride levels in the blood would be evaluated. Consideration should be given to evaluating mental development of children through indicators such as neurointegrative function tests. An assessment of indicators of health status would be performed utilizing data on immunizations received and dental care as determined by the prevalence of decayed, missing, and filled teeth. Additionally, family bene-

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fits could be assessed by evaluating indicators such as dietary data and immunization records for family members of WIC Program recipients.

3. The additional indicators to be included in this study would provide an opportunity to determine if more precise measures of nutrition and health status are available that could be used by participating local agencies.

Socioeconomic data such as ethnic origin, income, size of household, education, and participation in other food assistance programs, would be necessary for an adequate analysis of the data on nutrition and health status.

Methodology

A longitudinal study design would be utilized since it is the most appropriate means of assessing program effects in the context of individual benefits. Nutrition and health status of WIC Program recipients would be evaluated upon entrance to the program and re-evaluated at specified intervals. Participation in this evaluation by local agencies would be voluntary and limited to a small number of local agencies. Informed consent would be obtained from each recipient included in this evaluation.

Since the ability to draw strong conclusions from an evaluation is weakened by self-selection of participants and dropouts, this proposed evaluation would be designed with an incentive for participation and intensive followup of participants to encourage participation and decrease dropout rates. Additionally, since past disease experiences could affect the measurements, information on medical history would be obtained and used to control for the possible influences.

All data for each recipient would be sent to a central location for analysis. Data would be analyzed according to individuals and groups. Baseline data would be compared to data collected after program participation as one method for evaluating program effectiveness. Data would also be compared to reference standards and previous findings on the nutrition/health status of U.S. poverty and nonpoverty populations. Baseline data would be obtained at admittance to the program and followup data would be obtained during each subsequent trimester of pregnancy for women and at approximately 6-month intervals for infants and children.

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Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Only indicators for which the normal physiological variation is known would be included in this evaluation. Standardized tests and measures would be used for all indicators. Any recently developed techniques would be subjected to tests to determine their validity prior to use. The capability of the laboratory to perform analyses under conditions ensuring validity and reliability of data would be documented. It should be ensured that there is adequate time, money and manpower available for training, pretesting, standardizing, recording and analyzing the data collected during this evaluation.

Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Applications and Limitations

This proposed evaluation of the nutrition and health status of WIC Program recipients would provide an indication of the health and nutritional benefits derived through the WIC Program for those recipients in the selected local agencies.

In addition to providing an indication of the prevalence of stunting and obesity in infants and children and an estimate of weight gain during pregnancy and infant birth weight, which are all estimates of growth, this proposed evaluation would provide an estimate of the components of weight gained or more specifically, the contribution of adipose tissue to total body mass. Therefore, a better understanding of the effect of the WIC Program on growth could be ascertained.

For the assessment of iron nutriture this evaluation would go beyond measurement of hemoglobin and hematocrit values in WIC recipients and measure a number of more sensitive and specific indicators of iron nutriture including percent saturation of transferrin and the concentrations of plasma ferritin and erythrocyte protoporphyrin. This would provide a better indication of iron nutriture and make it possible to determine if low hemoglobin and/or hematocrit levels were due to iron deficiency or other causes such as illness, infection, or nutritional deficiencies other than iron.

Through the use of numerous indicators to assess growth and iron nutriture, it should be possible to make more definite conclusions pertaining to the observed changes and their relationships to the WIC Program. The incorporation of a wide range of biochemical tests in this proposed evaluation would make it possible to determine

Proposal III

Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

if nutrition and health problems, other than inadequate growth and iron deficiency anemia, are prevalent in the WIC Program recipients evaluated. Additionally, the effect of receipt of program benefits on the prevalence of these problems would be evaluated. The biochemical measurements of vitamins and minerals would provide information on the extent of low blood concentrations of nutrients tested. Through determining the levels of cholesterol and triglyceride in blood, it might be possible to identify, among WIC Program recipients, potential health problems associated with elevated levels.

Dietary consumption data, including information on use of dietary supplements, would provide information on dietary habits and an indication of types of foods commonly consumed by the study population. These data would provide for an assessment of changes in dietary practices after participation in the WIC Program. Such data would also enhance the interpretation of other indicators investigated through this evaluation. The extent to which WIC foods are used as a supplement or substitute in the diet might also be evaluated by comparing entrance and followup data.

An assessment of the health status of WIC Program recipients would indicate possible health benefits of the WIC Program. The use of neurointegrative function tests may provide an indication of a possible influence of the WIC Program on mental development of infants and children. However, because of the expense in time and money to perform tests of high reliability and the lack of suitable test procedures, the conclusions that could be made would be limited.

The assessment of family benefits through the collection and analysis of dietary data

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Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

and data on immunization records for siblings of WIC Program recipients would provide an indication of the impact of the WIC Program on the family unit. Since the WIC Program recipient is a member of this unit, he/she influences the attitudes and actions of other members. Therefore, it should be determined if the WIC Program has an effect on the families of WIC Program recipients. From this data it would be possible to obtain an indication of the extent to which WIC foods are shared by the family members and the influence of the program on the utilization of health services by family members not participating in the WIC Program.

The longitudinal study design of the proposed evaluation would make it possible to evaluate changes in nutrition and health status of WIC Program recipients over time and possibly identify what relationships exist between duration of receipt of program benefits and their effect on recipients' nutrition and health status.

The additional indicators to be included in this study would also provide an opportunity to evaluate their applicability for use by local agencies. It may be possible to identify more sensitive or precise techniques for identifying nutritional risk that could be used by health clinics. Early detection, identification, and treatment of nutrition and/or health risks are essential to restoration of desirable status. More precise techniques would strengthen the preventive aspects of the WIC Program. Additionally, they would enhance the administration and effectiveness of the WIC Program.

The sample for this proposed evaluation would be selected to be representative of WIC recipients. However, participation by local agencies and program recipients

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Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

would be voluntary. Consequently the results may not be representative of the WIC Program. The improved methodologies, quality control, and other measures instituted for the purpose of the evaluation are expected to have a positive influence on the quality of services provided. Therefore, results would represent the impact of the WIC Program only on recipients in the selected local agencies. However, the results in these selected local agencies would demonstrate the potential benefits and limitations that could be expected from the WIC Program. It is anticipated that the results would also provide information which could be used for strengthening other local agencies participating in the WIC Program.

Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Equipment and Expertise Required

Minimum equipment required by local agencies would include measuring devices for determining length of infants and height of children and pregnant women, beam balance scales for weight measurements, spectrophotometer for hemoglobin determinations or micro-hematocrit centrifuge and reader for determination of hematocrit. Since this equipment is essential for administering good health care, provisions should be made for obtaining it through funds from HEW, USDA or other sources if it is not available in the clinics.

Central laboratories with demonstrated capabilities for performing the specific tests and which are sufficiently large and well equipped to process the expected volume of samples must be selected to perform the required biochemical tests. All tests for a related group of indicators would be performed in a single laboratory. Computer facilities with capabilities for processing large volumes of data must also be available.

A team of investigators representing varied disciplines including biostatistics, epidemiology, nutrition, obstetrics and gynecology, and pediatrics would be required to develop and conduct this evaluation. Additionally, a consultant review board representing these disciplines should be established to assist the agency responsible for the development of the request for proposals and conduct of this evaluation.

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Proposal III Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients

Duration of Study

A minimum of 3 years would be required from implementation to completion of this proposed evaluation.

Cost

It is estimated that a contract for this proposed evaluation could be obtained for approximately \$1.75 million. This estimate does not include the cost of additional equipment or personnel that may be required for the collection of data by the local agencies.

Proposal IV Nutritional Status Evaluation of Recipients and Nonrecipients—Reaching Those Most in Need of Program Benefits

Introduction

This proposed evaluation would determine if the WIC Program is serving the individuals who are at greatest nutritional risk. Additionally, it would identify reasons for nonparticipation among individuals eligible for the WIC Program.

It is anticipated that the WIC Program could have the greatest impact through serving that segment of the population at greatest nutritional risk. Therefore, an evaluation of the degree to which individuals who are eligible for the WIC Program do not participate would be beneficial in order that procedures could be implemented to increase participation. Since the minimum period of time necessary for completion of this proposed evaluation is 3 years, this study presupposes that the WIC Program will be extended beyond September 30, 1978.

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Objective

The overall objective of this proposed evaluation is to determine if the WIC Program is serving those persons most in need of program benefits. The specific objectives are to:

1. Determine if individuals at greatest nutritional risk who meet USDA criteria for enrollment in the WIC Program are actually WIC Program recipients.
2. Identify the reasons persons who meet USDA criteria for the WIC Program are not WIC Program recipients.

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Scope

This proposed evaluation would identify infants, children, and pregnant women who are eligible for the WIC Program but who are not program recipients. It would deal with only those eligible nonparticipants residing within selected geographical areas served by local agencies participating in the program. The evaluation would provide for an assessment of their nutritional status to determine if those persons most in need of program benefits are participating.

For this evaluation, a small number of local agencies participating in the WIC Program (approximately 100) would be selected on a probability basis to be representative of the WIC population. Only local agencies which serve all three types of WIC participants—women, infants and children—would be included.

The scope of this evaluation is delineated according to each objective as follows:

1. Individuals who are eligible for receipt of WIC Program benefits on the basis of USDA criteria for income and residence but who are not WIC Program recipients would be evaluated in terms of their nutritional risk status. This would include those individuals who have never been recipients of the WIC Program and individuals who have formerly been recipients and are still eligible but are not currently participating (drop-outs).

The criteria used by the local agencies participating in this evaluation to establish nutritional risk would be applied to nonrecipients to establish their eligibility. These criteria would encompass the preventive as well as the remedial aspects of the WIC Program.

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The indicators that have been used by the selected local agencies to evaluate the nutritional status of WIC Program recipients would be used to evaluate the nutritional status of nonrecipients. For infants and children the indicators used would include: height, weight, hemoglobin and/or hematocrit values, and previous immunizations. For pregnant women the indicators used would include total weight gain and pattern of weight gain during pregnancy, hemoglobin and/or hematocrit values, and certain complications of pregnancy.

2. Individuals who are not recipients of the WIC Program but who are determined to be eligible would be requested to provide information on the reason(s) they do not participate. Information would be obtained on their knowledge of the existence and benefits of the WIC Program, their perception of their nutritional risk status, social stigma associated with receipt of program benefits, and logistical problems associated with participation such as transportation and child care. Furthermore, local variation in administration and eligibility criteria could be evaluated as to their influence on WIC Program performance.

Proposal IV**Nutritional Status Evaluation of Recipients and Nonrecipients—Reaching Those Most in Need of Program Benefits****Methodology**

Participation in this evaluation by local agencies would be voluntary, and informed consent would be obtained from each person to be included. The local agencies selected for inclusion in this evaluation would be limited to established local agencies participating in the WIC Program which have collected the required data from recipients, according to standard procedures, with good quality control.

Nonrecipients would be selected from the geographical area served by the local agencies participating in this evaluation. Sampling would be conducted by randomly selecting from census tracts households identified as predominantly economically needy. All persons considered nonrecipients for this evaluation would be determined to be economically eligible for the program prior to collecting additional data required for this evaluation.

The data required for this evaluation could be obtained through indicators that are customarily measured by local agencies participating in the WIC Program. Information on program recipients' nutritional risk conditions at the time of entrance to the WIC Program, identified through indicators commonly used to evaluate nutritional and health status, would be necessary.

The same indicators used to evaluate the nutrition/health status of recipients would be used for nonrecipients. Comparable procedures and quality control measures would be used when collecting data from each group to provide for comparisons between the two groups.

A determination of whether individuals most in need of program benefits are

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actually WIC Program recipients would be made by comparing data on recipients' nutritional status, obtained at the time of entrance to the WIC Program, with data on the nutritional status of individuals not receiving WIC Program benefits.

Individuals who are determined to be eligible for the WIC Program but who are not WIC Program recipients would be interviewed to determine reasons for nonparticipation. A standardized interview guide would be designed to determine the person's knowledge of the program and to identify possible problems related to program policies and operation, difficulties or hardships associated with program participation, philosophical attitudes toward the program that may be a deterrent to participation, and other factors which may affect program participation. The information provided by individuals who have never been recipients of the WIC Program would be evaluated separately from the responses provided by individuals who had previously participated but dropped out.

Data obtained when the recipients entered the program would provide for a determination of the nutritional status of the population being served by the WIC Program. This would be accomplished through a cross-sectional analysis of the indicators, as appropriate, to accepted reference standards and previous findings on the nutrition/ health status of the U.S. poverty and nonpoverty populations.

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Applications and Limitations

Through this proposed evaluation it would be possible to determine the extent to which those persons, residing within areas where the WIC Program is available, who are most in need of nutrition and health services are WIC Program recipients. This information is essential to an understanding of overall program effectiveness, since it would be expected that the program's greatest impact would be on that segment of the population most in need of program benefits.

Local agencies participating in the WIC Program that are effective at reaching the target population would be identified by comparing those agencies in which a large proportion of individuals at greatest nutritional risk are WIC Program recipients, with agencies in which a smaller proportion of individuals at greatest nutritional risk are program recipients. This would provide a means for identifying successful policies and practices in operating the program, and characterize populations most apt and least apt to participate. Additionally, reasons for nonparticipation would be ascertained from individuals eligible for the WIC Program who have either never been recipients or have dropped out of the WIC Program. This information would be used to improve policies and procedures to increase participation by that segment of the population most in need of program benefits.

In addition to determining if those persons at greatest nutritional risk are actually WIC Program recipients and identifying reasons for nonparticipation among eligible persons, this evaluation may provide an indication of effectiveness of the WIC Program in improving nutritional status. However, this capability would be dependent upon identifying a sufficiently large

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number of dropouts. A comparison of nutritional status of program participants with dropouts could be made.

This evaluation would provide an assessment of the nutritional status of WIC Program recipients at the time they entered the program. Children's nutrition-related problems would be demonstrated through the prevalence of underweight, obesity, stunting, and low hemoglobin/hematocrit values. Although this evaluation would provide much useful information, it has some limitations. It is not designed to determine the effect of program participation on nutrition and health status. Such a determination would be contingent upon identifying a sufficiently large sample of program dropouts during the conduct of the study. Whether this could be done is questionable. Additionally, while the indicators included in this evaluation are those which are practicable, a more comprehensive evaluation including additional indicators would provide more conclusive results.

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Equipment and Expertise Required

The equipment required would include measuring devices for determining length of infants and height of children and women, beam balance scales for weight measurements, spectrophotometers for hemoglobin determinations or microhematocrit centrifuges and readers for hematocrit determinations. Since this equipment is essential for administering good health care, it is presumed that such equipment is available in clinics. However, if this equipment is not available, provisions to obtain it should be made through HEW, USDA, or other sources.

Expertise in survey research would be required to obtain adequate coverage of non-WIC recipients.

Duration of the Study

A period of 3 years would be required to complete this proposed evaluation.

Cost

It is estimated that the contract for this proposed evaluation could be obtained for approximately \$750,000. This estimate does not include the cost of additional equipment or personnel that may be required for the collection of data by the local agencies.

The indicators that are currently available to assess nutrition and health status are influenced by a wide range of factors other than nutrition, including genetic and environmental factors. The limitations of existing methodologies for assessing the impact of nutrition-related programs on the health of individuals or groups of persons clearly demonstrates the need for further research. Improved study designs for evaluations involving human subjects are needed. Additionally, improved methodologies are needed for more specific and more precise indicators of nutrition and health status, especially those which can be practicably implemented in health clinic environments. These improvements would make possible more accurate evaluation and more effective administration of nutrition intervention programs.

The classical models of experimental design, which underlie research on animals, are not ethical for evaluating nutrition intervention on humans. Therefore, there is an urgent need for more research to develop new and convincing epidemiological and statistical designs for such evaluations.

One of the most promising approaches for evaluating health benefits pertains to measures for determining physical fitness. Most of the more sensitive measures that are currently available are not yet adapted for screening large groups of people. For example, some procedures require relatively expensive equipment and specialized technicians, and the results are difficult to interpret. Nevertheless, physical condition must be considered when advising dietary regime in conjunction with a nutrition intervention program. Closely aligned with nutrition, and particularly energy balance, is physical fitness and work capacity; maintaining an appropriate level of activity or exercise is important for

optimal performance and prevention of obesity, cardiovascular difficulties or other conditions. Simple methodologies for quantification of cardiopulmonary capacity, muscle strength, and physical endurance would enhance the assessment of health benefits and nutritional status as well as increase the potential effectiveness of all nutrition intervention programs.

More accurate noninvasive procedures for determining body composition (leanness relative to fatness) are essential for meaningful evaluation of nutritional status of large numbers of people. Knowledge of the amount of lean body mass or amount of fat is essential to quality health care for all persons and particularly for pregnant women and young children. Measurements of body composition assist in determining the sufficiency of total food consumption in relation to the total energy expenditure, including exercise, by the individual. The height-weight relationships and skin-fatfold thickness arm circumference measures that are currently used as indicators are too imprecise. The more precise measures that are available such as underwater weighing, isotope counting, and fat soluble gas techniques, are all presently too complicated and expensive for large scale use in nutrition status studies performed in health clinics. Simplified adaptations of some of these noninvasive techniques that could be performed by health clinic personnel are needed to provide accurate measures of leanness and fatness.

The quantitative and qualitative determinations of dietary consumption must be made with increased accuracy for the assessment of dietary status. An accurate determination of dietary status is a key predictor of nutritional status and would have a major impact on providing quality preventive health care. Determination of dietary status would indicate persons at

potential risk of nutritional problems prior to demonstration of overt abnormalities. However, the methods that are currently utilized by most health clinic personnel to determine dietary status are too imprecise. The current dietary history procedures are of limited usefulness because of the time needed and extensive calculations required for the estimation of nutrient consumption. Lack of information on the variability of the nutrient content of foods is a further complication. The inability to accurately and efficiently estimate food and nutrient consumption by individuals is a major limitation in nutrition assessment and administration of nutrition intervention programs. The inability to determine and document intakes of food additives and possible contaminants is an additional limitation. Therefore, the development of improved methods for determining food consumption is essential.

It is necessary to develop biochemical methods which can be used by health clinic personnel to determine the concentration of an increased number of nutrients in body tissues and fluids. For a more complete understanding of the relationship of nutrients to nutritional status, it is important to know the levels of nutrients that have been distributed to body cells as a result of food consumption, digestion, absorption and transport. Most of the widely used biochemical methods available to assess nutritional status are indirect or imprecise. In many instances the body components that are used as indicators are so nonspecific that it is difficult to identify the causative factors in abnormal conditions. Many methods measure the concentrations of nutrients in transport at a given time. This concentration may reflect recent diet or physiological conditions and thereby may not allow determination of nutritional status. Hence, there is a need for improved biochemical procedures that

would be applicable to the assessment of large-scale programs.

There has been great interest in evaluating the effects of nutrition on mental development through nutrition intervention programs. Methodologies currently available and used to assess mental development include neurointegrative function tests and head circumference measurements. Limitations of these methodologies were recently discussed in a publication by Nutrition Foundation, Inc., in which it was stated that psychometric tests do not adequately measure mental development and unless head size is grossly inappropriate for body size it is not of significance to intelligence. Therefore, the assessment of mental development requires further research prior to performing routine assessments involving large groups of people.

The general areas requiring further research as identified in this section are essential to an understanding of nutrition and health status. Through further research on study design and indicators of nutritional status and through the development of tools with which to assess indicators, the means to evaluate nutrition intervention programs would be developed. Such research is imperative if the impact of Federal programs on the nutrition and health status of the population is to be adequately assessed. Furthermore, the availability of accurate methods to assess these indicators, that are sufficiently simple to be implemented by health clinics, would enhance the effectiveness and administration of nutrition intervention programs. Thus, additional funds should be appropriated promptly to conduct the research that is required to more effectively utilize the resources available through the many nutrition intervention programs in the United States.

Indicators and Standards

Their Importance and Limitations

Introduction

An indicator which is useful for the assessment of nutritional status is one which changes with nutritional status. The more closely changes in the indicator correspond to changes in nutritional status, the more useful the indicator. Since most of the indicators currently used to evaluate nutritional status are physiological measures, they are influenced by a wide range of genetic and environmental factors in addition to nutritional status.

The purpose of scientific investigations is to determine relationships and their intensities by using appropriate study designs—including comparison groups—and methods of analysis which control for influences other than those being studied. Ideally, scientific methods which control for most of the influences of factors other than nutrition could be applied to an evaluation of nutritional status. These ideal circumstances are neither desirable nor attainable in studies involving human subjects and utilizing data obtained through a service program. Consequently, in the proposed evaluations, changes in indicators may be due to changes in nutritional status of WIC Program recipients or to changes in one or more of the other factors which affect the indicators. The information which can be derived from some specific indicators and factors, other than nutrition, known to influence these indicators will be presented in this section.

The indicators and standards, as presented in this report, are currently used in nutrition and health status evaluations. In the proposed evaluations, indicators are to be compared to available standards in order to provide an evaluation of nutrition and health status of WIC Program recipients.

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These comparisons would provide an indication of the effectiveness of the WIC Program.

Since the indicators used to assess nutritional status measure biological variables, the phenomenon of regression to the mean must be taken into consideration in the evaluation of nutrition intervention programs. The phenomenon of regression to the mean is the tendency of a biological variable which is extreme on its first measurement to be closer to the center of distribution on subsequent measurements. This results from variability of biological variables and the difficulty of measuring them precisely. Due to the phenomenon of regression to the mean, an indicator value showing inadequate nutrition on an initial measurement could improve on subsequent measurements without improvement in nutritional status. Thus the apparent but unreal improvement in nutritional status could lead to false conclusions concerning the impact of an intervention program on nutritional status. Study design and data analysis procedures have been developed to control for the influence of the phenomenon of regression to the mean. To ensure valid results and appropriate conclusions, these procedures must be incorporated in studies which assess the impact of nutrition intervention programs through changes in indicators of nutritional status. ^{21/}

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The indicators recommended for inclusion in the proposed evaluations are those routinely used for determining nutritional status. They include anthropometric, biochemical and dietary indicators, plus additional indicators of health status, neuro-integrative function, family benefits, duration of receipt of health services and WIC Program benefits, and socioeconomic status. The applications and limitations discussed for the various indicators in this section pertain to current methodologies.

1. Anthropometry

Anthropometric measurements are useful indicators for assessing nutritional status of populations. These measurements permit the detection of nutritional inadequacies manifested by abnormal growth patterns. Additionally, they are essential for the assessment of obesity. Many different types of body measurements can be utilized in anthropometric studies. In large-scale surveys validity, reliability and simplicity of the measurements are major factors influencing the choice of indicators.

a. Height and Weight Assessment in Infants and Children

Two of the most commonly used anthropometric measurements in surveys of nutritional status of infants and children are height (length) and weight. These two measurements are relatively simple to perform. Measurements are assessed in relation to age using standards to determine if infants and children have reached expected size.

Since adequate growth requires adequate intake of essential nutrients, deficits in height and/or weight may be evidence of undernutrition; excesses in weight may be evidence of obesity. Anthropometric measurements reflect both recent and past nutritional experiences. Therefore, these indicators provide valuable information and would be an essential component of an evaluation of the WIC Program.

Accurate measurement of height and weight is very important if the true picture of the nutritional status of a given population is to be obtained. In performing anthropometric measurements as part of a data collection system, standardized equipment and procedures should be used.

The equipment required for the determination of length, height and weight are measuring boards for length, suitable measuring devices for height and beam balance scales for weight. These tools are frequently found in the clinical setting and should be available in all clinics serving infants and children. To ensure accuracy in measurement they should be periodically checked and standardized. Height and weight determinations could be made by nonprofessional persons. However, since the validity of these anthropometric measurements depends to a large extent on the care with which they are made, supervision and training would be essential. Preferably in any clinic these measurements should be compared to accepted standards and made by one individual or by selected persons comparably trained.

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Although height and weight measurements provide valuable information, they do have some inherent limitations. Weight measurements are transient and subject to variation depending on the time of day the measurements are taken, especially the time since water or food ingestion. Nutrition is only one of many factors affecting growth, and there is a wide range of normal variability even within seemingly similar population groups. Race and sex affect body size, and birth weight influences body size for at least a year after birth. Therefore, these variables must be considered in data analysis.

Growth pattern as determined by body size and weight may not be evidence of appropriateness of dietary intake, since many other factors, including genetics and energy expenditure through activity, influence growth. Therefore, these measurements should be interpreted carefully, taking into account biochemical and dietary findings. To overcome some of these limitations in interpreting height and weight data, serial observations should be made rather than a single measurement. Two measurements over a defined period of time permit calculation of growth, while one measurement only shows size achieved.

b. Assessment of Body Composition

In a comprehensive nutrition evaluation an assessment of body composition is necessary. The percentage contribution of different tissues to total body mass is influenced by nutritional status. Measurement of

the contribution of lean body mass and adipose tissue is especially pertinent to nutritional assessment.

Although many methods are available for the assessment of body composition under laboratory conditions, the determination of skin-fatfold thickness and arm circumference are the only means currently available for use in the field. Measurement of skin-fatfold thickness is helpful in assessing obesity since a large proportion of the body's adipose tissue is located under the skin. Triceps and subscapular skin-fatfold determinations are the measures most commonly used. Assessment of lean body mass is more adequately done by measurement of arm circumference.

Special training for personnel and standardized calipers would have to be provided to ensure accuracy. Such calipers can be purchased for \$125-\$175.

Body composition in terms of relative contribution of fat and lean body mass is influenced by a number of factors other than food consumption, such as genetics and energy expenditure. Therefore, these measurements should be interpreted carefully, taking into account the various factors that may have an impact.

c. Assessment of Weight Gain During Pregnancy

Total weight gain during pregnancy and the pattern of weight gain are two of the principal influences of the outcome of pregnancy. Total

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weight gain is one of the most significant measurements predictive of the birth weight of the infant. The pattern of weight gain, on the other hand, can be indicative of potential maternal health problems.

The normal curve of weight gain is characterized by little gain during the first trimester, a rapid increase during the second and some slowing in the rate of increase during the third trimester. Inadequate maternal nutrition can result in lesser amounts of weight gain and/or alterations in expected weight gain pattern.

Energy intake is an especially important determinant of weight gain. Therefore, the assessment of weight gain during pregnancy provides an indication of adequacy of energy intake. Early warnings of potential health problems such as toxemia of pregnancy and obesity would be derived from information on pattern of weight gain.

A beam balance scale would be required for the assessment of weight gain during pregnancy. This piece of equipment is usually available in clinics and should be available in all clinics serving pregnant women. Periodic checks for accuracy of the instrument should be made. Measurements can be made by nonprofessional persons. However, validity depends on the care with which the measurements are made, and training is necessary. The measurements should be compared to accepted standards and preferably should be performed by the same individual or selected individuals comparably trained.

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There are major limitations to using weight gain during pregnancy in an evaluation of nutritional status. Two of the major limitations are the difficulties in dating the last menstrual period and in determining whether weight gain reflects fluid retention or excessive fat accumulation or tissue related to the products of conception.

d. Assessment of Outcome of Pregnancy

The major goal of prenatal care is a healthy outcome of pregnancy for both mother and infant through the identification of preventable problems and treatment of existing problems. Infant birth weight and gestational age (duration of pregnancy) are two indicators usually assessed in the evaluation of pregnancy outcome.

Gestational age could be derived from records at WIC projects by comparing date of reported last menstrual period and date of infant birth. Infant birth weight could be obtained from hospital records or birth certificate.

Although maternal nutrition and health care are major factors influencing the outcome of pregnancy, and inadequate dietary intake is associated with low infant birth weight, a number of other factors also exert an influence. Included among these are heredity, short interconceptual period, infections, smoking, alcohol, drugs, prepregnant nutritional status and weight, maternal age and parity, and maternal height. These factors have an impact on health and conse-

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quently should be considered when evaluating gestational age and infant birth weight data.

Measurement of infant birth weight and gestational age is considered essential to an evaluation of the impact of the WIC Program on pregnant women and for a subsequent evaluation of nutritional status of the infant and child.

2. Biochemistry

a. Iron Nutriture

A number of biochemical measurements are useful in the assessment of iron nutriture in pregnant women, infants, and children. The most commonly used measures are hemoglobin and hematocrit determinations. Although other aspects of nutrition and health could affect hemoglobin and hematocrit values, in the segment of the population being served by the WIC Program, the principal determinant is believed to be the status of iron nutriture.

A hemoglobin determination provides information on the concentration of hemoglobin in the blood, whereas a hematocrit determination is a measure of the percent of blood that is made up of packed red blood cells. Iron deficiency anemia results in a fall in both these values. Hemoglobin determination is the more direct means of measuring iron nutriture. Additionally, quality control measures are more readily instituted for hemoglobin determinations. However, hematocrit determinations are simpler to perform and less subject to error. In respect

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to other biochemical tests, both are regarded as being simple, fast, reliable, readily available, and inexpensive methods of assessing iron nutriture.

For hematocrit determinations microhematocrit centrifuges and readers are needed. Hemoglobin determinations require a photoelectric colorimeter or spectrophotometer which can be purchased for \$250-\$500. Frequent restandardization of equipment is necessary, and the institution of a system of quality control is essential if valid and reliable results are to be obtained. The equipment and expertise may be out of the range of capabilities of some WIC projects and current pending legislation regarding laboratory standards may affect implementation of hemoglobin testing in all WIC projects. ^{22/}

Although determinations of hemoglobin and hematocrit are essential components of nutrition assessment, there are a number of limitations to their use. The development of significant deviations from the norm for hemoglobin and hematocrit values is a late finding in the progression of iron deficiency and is therefore only apparent when iron deficiency is relatively long standing. Short-term iron deficiency would not be detected using hemoglobin and hematocrit measurements because of the wide normal physiological variation and the relatively long life span of the hemoglobin containing red blood cells. For infants less than 6 months of age, the wide physiological variation in

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these values resulting from adjusting to extrauterine life precludes their use for the assessment of iron nutriture.

Interpretation of laboratory data is often difficult and does not always correlate with clinical or dietary findings. To establish that a population is normal with respect to hemoglobin and hematocrit involves the use of appropriate standards for defining anemia. There is not complete agreement among authorities concerning the level of hemoglobin at which a diagnosis of anemia should be made, especially in pregnant women, infants, and children. Although the measurement of hemoglobin and hematocrit values is useful for assessing iron nutriture and anemia in populations, further tests are necessary to assess iron nutriture in individuals.

There are several biochemical tests for the assessment of iron nutriture, other than hemoglobin and hematocrit determinations, that should be incorporated in any comprehensive nutritional evaluation. Determinations of percent saturation of transferrin, erythrocyte protoporphyrin and concentration of serum ferritin are more specific and sensitive measures of iron nutriture than hemoglobin and hematocrit measurements. However, the equipment and expertise required to perform these measurements would necessitate contracting with specialized laboratories.

b. Additional Biochemical Assessment

There are additional biochemical studies that could be performed in

an indepth evaluation of nutritional status. Some of the tests involve the determination of nutrient concentrations in body fluids and others assess biochemical functions related to adequacy of nutrient supply.

The investigation of additional indicators would (1) provide an evaluation with increased scope, encompassing a greater number of nutritional risk indicators and (2) substantiate conclusions about nutritional status through using numerous indicators for the same nutrition and/or health condition. Nutritional status could be evaluated in terms of additional nutrients, and the potential would be available for investigating possible health hazards in the population.

Some of the biochemical tests which are applicable to an indepth evaluation of the WIC Program include determination of serum cholesterol and triglyceride levels and assessment of certain vitamins and minerals. Biochemical tests are available to assess these nutrients. The tests are considered valid and reliable when done under well controlled laboratory conditions by specialized personnel. All procedures pertaining to the collection of the sample and the laboratory analysis should be developed by a recognized authority for the determination being considered. Since these biochemical tests are expensive the probable usefulness of each indicator to be evaluated should be carefully considered before it is added to any protocol.

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The most prevalent health problems in infants and children are accidents and infections. Therefore, assessment of accidents and infections would reflect the quality of health care. In addition, infections may be related to nutritional status. However, experience has shown that it is impractical to define and assess accidents and infections because of the difficulty involved in identifying and reporting these two variables.

Mortality rates and hospitalization rates have been recommended for health assessments. However, the mortality rates of WIC Program recipients are expected to be so low that they would be of little use in studying health benefits. Hospitalization data are difficult to collect. Furthermore, the interpretation of such data would be inconclusive with regard to health status because of the varied causes of hospitalization.

Performing hemoglobin or hematocrit determinations should be a capability of all health care facilities serving pregnant women, infants, and children. Presence of such a determination would provide one indication of the adequacy of the health care component. Acceptable health service would indicate a hemoglobin or hematocrit determination for each full-term infant 6-12 months of age and earlier for preterm infants.

Adequate immunization is also a standard for good health care. It indicates clinic attendance as well as availability of health care facilities. Receiving immunizations protects the child from certain diseases and provides the opportunity to receive other health services. Since immunizations require contact

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with a health professional, it is expected that health problems existing at the time of immunization would be recognized and treated or referred for treatment. Additionally, it is expected that at least in certain clinic settings health education would be provided in an effort to effectuate the development of good health habits and prevent the future development of health problems. Therefore, the receipt of immunizations would have a beneficial influence on the child's overall health status and could be used as an indicator to assess the child's health. In the proposed evaluations immunization records would be compared with the standards of the American Academy of Pediatrics to provide an indication of health status, utilization of health services, and quality of health care.

These data could be obtained from clinic records. Administrative time would vary according to the program. In those programs having close health facility ties, the data could easily be retrieved from clinic records. In other settings with children attending various health facilities the data may be more difficult to obtain.

Dental care is an essential component of total health care. An assessment of dental caries status in children would provide an indication of the utilization of health services and the quality of health care being provided. However, the observed dental health status would partially reflect fluoridation and prevailing dental practices which must be considered when evaluating the data.

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5. Neurointegrative Function Testing

Mental development in children is related to many genetic and environmental factors which include overall health status and nutritional status. Therefore, assessments of neurointegrative development and behavior should be considered indicators of nutritional status of infants and children in the WIC Program. However, conclusions which can be drawn from these variables will be limited since testing instruments are inadequate, and results are affected by a wide variety of factors both genetic and environmental.

6. Assessment of Family Benefits

To enhance understanding of the impact of the WIC Program, it would also be useful to assess any benefits that household members other than the WIC Program recipient(s) might be receiving. The impact of the WIC Program may not be limited to only program recipients. It is possible that receipt of services in the health unit, such as nutrition education and recommended health practices, may have an impact on additional household members. An evaluation of dietary intake for selected household members could be performed to determine dietary habits and estimate nutrient intake. Such an evaluation would demonstrate if the WIC recipients' dietary practices are similar to the practices of other household members. Furthermore, through periodic evaluations changes in food habits of various household members could be assessed.

In addition to dietary intake, the health practices of household members other than WIC Program recipients could be investigated. An indication of the quality of health care could be assessed through consideration of immunization rates for siblings of infants and children receiving WIC Program benefits.

7. Duration of Receipt of WIC Program Benefits and Health Services

Information on duration of receipt of WIC Program benefits, receipt of health services, and missed appointments is necessary for interpreting data pertaining to nutrition/health status. Additionally, such information would indicate the effectiveness of the WIC Program as an incentive to participate in health services. Those projects demonstrating good attendance records and effective health programs could be selected to identify successful practices for the enhancement of less effective programs.

Good nutrition results from dietary practices which provide essential nutrients in adequate quantities over a long period of time. Therefore, it has been suggested that the WIC Program would not be effective unless it was administered over a long period of time. Correlation between duration of receipt of WIC Program benefits and growth, hemoglobin or hematocrit values, weight gain during pregnancy and outcome of pregnancy determinations would demonstrate the impact of duration of receipt of WIC Program benefits on health and nutritional status of recipients. This information would aid in the development of sound program policies.

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Standards for Comparison

8. Socioeconomic Status

Information about the socioeconomic status of WIC Program recipients is essential for an understanding of the population being served by the WIC Program and for the development of sound program policies. Such information has proven useful for stratifying populations when interpreting data from nutritional status surveys.

Socioeconomic data that should be obtained includes: income from wages, income from other sources including income-in-kind, household size, education of head of household, and ethnic origin. This information could be obtained through interviews. However, it must be recognized that some individuals are sensitive about disclosing certain socioeconomic data, which may affect the validity of data or may result in nonparticipation in some instances.

In order to evaluate nutrition and health status, values of indicators measured are customarily compared (1) to reference values (standards) (2) to data obtained from other previous studies of similar groups and/or (3) between two or more groups receiving different "treatments" in the same study. Assuming that methodologies are comparable, the primary limitations are uncontrolled environmental factors and dissimilarity of "test groups" when comparing a study with previous studies or two groups in the same study. Reference values or standards are useful when interpreting biological data, but their limitations should be recognized.

Current standards for nutritional indicators were developed considering previous studies and available scientific knowledge. However, studies have been limited by available methods and they usually involve only a small number of subjects because of the high cost and other limitations on human experimentation. Additionally, some types of experiments are not done because of ethical considerations. Most of the indicators for nutrition/health status in current use are affected by factors such as genetics, environment and disease status. Since it is not possible to control for all these influences, especially in studies involving human subjects, it is difficult to interpret data or to reach definitive conclusions. Therefore, the kinds and quantities of nutrients required to maintain good nutrition/health status are not precisely known, and standards for comparison are not explicitly defined. Standards usually attempt to control for influences of sex, age, and other factors for which the effect on nutritional indicators is known. For example, the effect of altitude on hemoglobin and hematocrit values is widely

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recognized. Therefore, standards for hemoglobin and hematocrit were developed taking into account these factors. Other factors also influence nutritional indicators. However, their effects have been less clearly defined which has precluded differentiation of their influences when establishing standards. For example, ethnic origin has been related to nutritional indicators. Black children are taller on the average than children of other ethnic groups of the same age, and the "normal" value for hemoglobin in blacks is believed to be lower than the "normal" value for whites. However, since this relationship has not been precisely defined, ethnic origin has not been considered in the development of standards.

Standard curves and cutoff points are the two types of standards used in the evaluation of nutritional status. When using standard curves, deviations from the normal distribution are measured as an estimate of nutritional status. When using cutoff points, values are compared to a selected value on the normal distribution. Values at or above this level are considered adequate whereas values below this level are considered inadequate. The use of cutoff points is questionable, and authorities disagree on the values which should be used to determine adequacy of nutritional status. However, for many indicators of nutritional status, they are the only standards available for comparison.

The interpretation of standards is complicated by the fact that standards represent different levels of nutritional adequacy. Standards for some indicators represent the average value for a "normal population." Other standards represent the minimum or maximum levels for nutritional indicators, as appropriate, beyond which medical complications occur. Still other standards

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represent the estimated optimal level for a nutritional indicator. However, in no case is it known if the value for a nutritional indicator established by the standard truly represents the optimal or adequate level, as appropriate, for health and performance.

The Committee recommends that various methods of data analysis be used when practicable to determine nutritional status or the impact of a nutrition intervention program. It is recommended that the data be represented in distributions for the groups being studied and that comparisons be made with distributions obtained in previous appropriate studies. It is also recommended that comparisons be made to standard distributions or values, as appropriate. The specific standards to be used should be appropriate for the group being studied. Some of the standards currently available for consideration are as follows:

For the assessment of height (length) and weight in infants and children, it is recommended that the standards developed by the National Center for Health Statistics (NCHS) based on the Fels Institute data for children and infants 0-2 years of age, and HES/HANES data collected by NCHS for children 2-18 years of age, be used.^{11/}

For the assessment of total weight gain during pregnancy, it is recommended that the standards of the American College of Obstetrics and Gynecology which recommend a woman gain 10-12 kg (22-27 lbs) throughout the course of pregnancy be used.^{20/} To assess the pattern of weight gain during pregnancy, it is recommended that the curve of "normal" weight gain related to duration of pregnancy developed by the National Academy of Sciences, be used.^{23/}

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For the assessment of hemoglobin and hematocrit values of pregnant women and infants, it is recommended that comparisons be made to findings on the nutrition/health status of the U.S. poverty population and U.S. nonpoverty population reported in the Collaborative Study.^{24/}

For evaluation of hemoglobin and hematocrit values of preschool children the Committee recommends comparisons be made to the standards published by the National Center for Health Statistics.^{6/}

For the assessment of serum cholesterol and triglyceride levels and levels of certain vitamins and minerals during pregnancy, it is recommended that the standards to be published by the National Research Council in 1977 be used.^{25/}

For dietary evaluations, it is recommended that comparisons be made to standards established through the appropriate use of the Recommended Dietary Allowances of the National Research Council of the National Academy of Sciences.^{26/}

The Advisory Committee on Nutrition Evaluation is recommending various studies to evaluate the effectiveness of the Special Supplemental Food Program for Women, Infants and Children (WIC Program). To provide information essential to future program development, the studies have been designed to investigate the nutrition/health status of persons served and the benefits derived by program recipients. It is believed that the most comprehensive and beneficial evaluation of this program would be provided through a combination of the proposed evaluations included in this report.

Any evaluation that is to provide information for use in developing legislation which might extend this program beyond September 30, 1978, is necessarily limited by time constraints to analysis of currently available data. For data to be analyzed prior to September 30, 1978, it would be necessary to implement Nutrition Evaluation Using Existing Data (Proposal I) as expeditiously as possible. While the data may include a large degree of variability and the results may not be entirely representative of the WIC population, it is believed that some conclusions and generalizations could be made that would be beneficial to the understanding and future development of the WIC Program. This evaluation would also determine which indicators of nutritional status could feasibly be included in future evaluations and would suggest refinements in methodologies for future nutrition surveillance of the WIC Program. Therefore, information gained from Proposal I would expedite implementation of Proposal II.

The recommendations pertaining to implementing Proposals II, III, and IV are contingent upon the WIC Program being extended beyond September 30, 1978. At such time

when it is known that the program will be extended, Nutrition Surveillance (Proposal II) should be implemented. This particular proposal has the potential for having much more of an impact on the WIC Program than any other single evaluation presented. This continuous evaluation would provide for assessment of the nutrition/health status of persons entering the WIC Program and an evaluation of the changes in status of persons participating in the program. It would also provide a direct means for improving the administration of the WIC Program and the delivery of health services by local health agencies participating in this program.

Since the determination of nutrition and health status would be limited to a few customary indicators in Proposal II, an Indepth Evaluation of Nutrition and Health Status of WIC Program Recipients (Proposal III) would more precisely define the nutritional status of the population participating in the WIC Program, identifying previously unrecognized nutritional needs and defining in greater detail the impact of the program. An Evaluation of Nutritional Status of Recipients and Non-recipients--Reaching Those Most in Need of Program Benefits (Proposal IV) would provide information on the extent to which the WIC Program is serving individuals at greatest nutritional risk and the reasons for nonparticipation of eligible individuals. The Committee believes that Proposals III and IV would provide a better understanding of the present and potential benefits of the WIC Program.

The Committee also recommends that additional funds be allocated for conducting research, possibly in coordination with other agencies, such as NIH, on nutrition and health assessment. Improved methodologies for the assessment of physical

Recommendations

fitness, body composition, dietary consumption and food utilization, body content of essential nutrients, as well as improved neurointegrative function tests and epidemiological and statistical design, are necessary to accurately determine the impact of nutrition and health intervention activities, such as the WIC Program, on the nutrition and health status of recipients.

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The Special Supplemental Food Program for Women, Infants, and Children is open to all eligible persons regardless of race, sex, color, creed, or national origin.

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